

Most Wonderfully Illustrated Magazine in the World

Popular Science

FOUNDED MONTHLY 1872



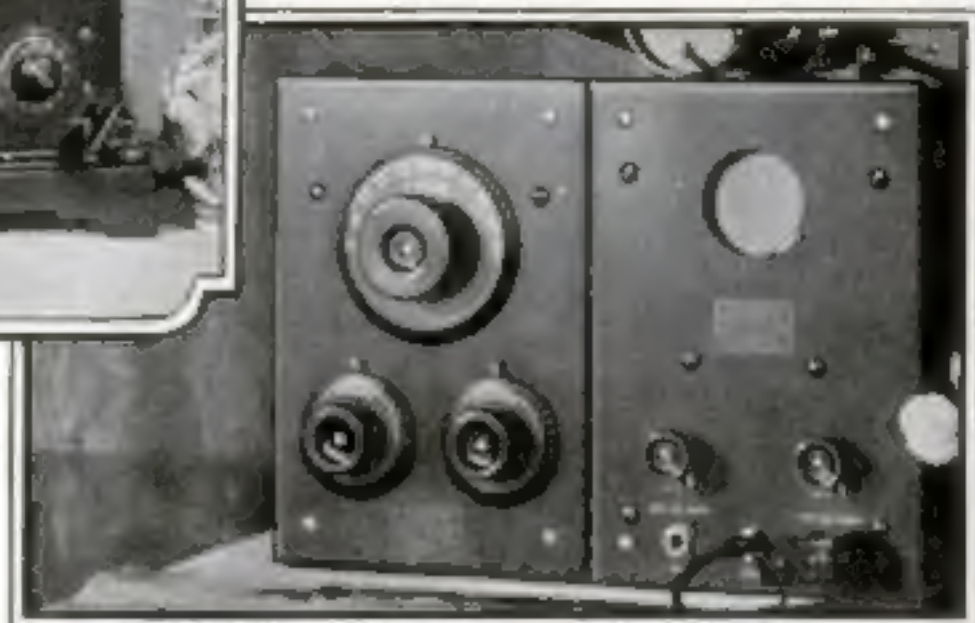
MAY Tire Pump Operates Ingenious Paint Sprayer—Page 79 25 CENTS

Will Rogers Tells Why We Laugh



Radiola V

Radiola V is built for a life time—solidly—ruggedly. In principle and performance, it is the same as Radiola RC—detector with two stages of audio amplification. With the same long distance reach. And the same keen sensitiveness. A pleasing and unobtrusive piece of furniture in its neatly finished metal casing. Dependable always—and simple enough for anyone to operate.



Radiola RC

Radiola RC is one of the nation's most popular long distance receivers. Compact—efficient—with a sensitive detector, and two stages of amplification, for louder, clearer reception of distance. Nicely made—and attractively finished—in solid mahogany.

A New Improvement Lowers the Cost!

Dry Cells Replace Storage Batteries

A new vacuum tube has made it possible. Radiola V and Radiola RC have been topping them all in popularity for dependability and long range—receiving over thrilling distances—up to 1,500 miles and more. Now both are converted to dry battery operation. This means greatly lowered cost—does away with bulky storage batteries—gives the far-away farmer the same good service it gives the city man.

No more need for expensive storage battery and charger. A big saving! And a saving made greater by the new offer—a combination offer of receiver and accessories—complete at a price remarkably low.



This symbol of quality
is your protection

Radiola V or Radiola RC Complete \$142.50

The New Way: Complete for dry battery operation, including three WD-12 Radiotron vacuum tubes; head telephones; "A" battery consisting of three dry cells; "B" battery consisting of three 22½ volt units. \$142.50.

The Old Way: The price of Radiola V or Radiola RC when equipped for storage battery operation, formerly came to \$207.50.

"There's a Radiola for every purse"

at the nearest Radio or Electrical Store

Radiola

REG. U.S. PAT. OFF.

Radio Corporation of America

Sales Department
233 Broadway
New York

District Sales Offices
10 So. LaSalle Street Chicago, Illinois
433 California Street San Francisco, California

Send for this Free Booklet

If you can't have a \$350 Radiola—want something bigger than a \$25 Radiola—write for the booklet. Plenty of in-between sets. The booklet tells all about 'em.

RADIO CORPORATION OF AMERICA
Dept. 2 P. Co., 233 Broadway, New York
Please send me your free Radio Booklet.

Name _____

Street Address _____

City _____

R. F. D. _____

State _____

 COLUMBO	 WATSON	 BROWN	 BENTLEY	 HARRIS	 LAWSON	 LAWSON	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY
 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY
 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY
 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY
 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY
 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY
 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY
 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY	 BENTLEY

Victrola No. 300
 \$250
 Victrola No. 300, electric, \$290
 Mahogany, oak or walnut
 Other styles \$25 to \$1500

The strongest endorsement ever given to any musical instrument

All these great artists and many others famous the world over have chosen the Victrola and Victor Records as the one medium to perpetuate their art. Play their Victor Records on the Victrola No. 300—illustrated above—and you will know the reasons for their choice. Ask the nearest dealer in Victor products to send a Victrola and a selection of Victor Records to your home.



Victrola

Look for these trade-marks. Under the lid. On the label.
 Victor Talking Machine Company, Camden, N.J.

POPULAR SCIENCE MONTHLY

MAY, 1923; Vol. 102, No. 5
25 cents a Copy; \$2.50 a Year



Published in New York City at
225 West Thirty-ninth Street

MAN progresses. Only 12,000 years separate us from our ancestor of the stone age—he of the shambling gait and receding forehead. He lived in a cave, fought wild animals with stones and clubs and feared thunderbolts. Science is responsible for man's mastery of the elements.

WITHOUT science man today would amount to as little as the platypus of which we tell on page 66. Queer combination of animal and bird, it has failed to keep pace with the world's progress. Taken from its native Australia, it dies. It cannot adapt itself to environment. Man survives because science has taught him such adaption.

MILLIONS of years ago a sea worm invented the human backbone. On page 32 Dr. E. E. Free and Dr. William K. Gregory tell how the fish, reptile, and ape also contributed to the complex machinery of the human body. Nature is the great inventor. With the body mechanisms as models, science devised numbers of machines that man might have a harmonious home on this planet. It is science that gives man his supremacy over animals.

NATURE built the body machine. Science teaches us to keep it well oiled—to keep it free from disease. On page 40 Dr. Lyman Fisk, noted health authority, tells of the chances of the fat man and the slim man in life's race. But with all our knowledge we know as little of the possibilities of medical science as the fly on a bald head knows of the brain beneath it.

TWO scientists assert they can dispel fogs and possibly rain by dropping electrically charged sand into clouds. Their story is told on page 29.

Once men would have been burned alive for such a statement. Today human faith in the possibilities of modern science is boundless. Men will marvel at this scientific miracle for a few weeks. Then, taking it for granted, they will dismiss it, to center their interest on some newer gift of science.

A MODERN story of buried treasure is printed on page 69. In it are the conventional human motives—adventure and money. But there is no pirate island; no sheepskin chart, written in blood. The treasure is buried deep in the mud of New York harbor. An electrically charged probing finger of steel is being used to locate it. Science in electricity has provided man, born with two hands, with millions of hands and strength beyond reckoning. And our ancestor, of 500 generations ago, shivered in fear as lightning illumined his gloomy cave!

RADIO stations are being established in the Arctic to flash blizzard warnings. The story is told on page 61. It means a chain of sentinels off in the earth's wastes that will protect our lives and chattels and add to our comfort and happiness. And so science pulls the laggard world along. It constantly is finding its magic way from the laboratory into our lives. Academic achievements become household utilities and give safety and certainty to life.

THERE is magic in science. A Washington inventor predicts that radio will enable us to see moving photographs of scenes being enacted miles away.

See Table of Contents on page 127

That is real magic. Read the story on page 67, then ponder on the story of the clerk in the United States Patent Office who, in 1822, resigned because there was nothing more to invent.

POPULAR SCIENCE MONTHLY

Issued monthly. Single copy, 25 cents. Yearly subscription in United States, its possessions, and Canada, \$2.50; foreign countries, \$3.

Entered as second-class matter Dec. 28, 1913, at the Post Office at New York under the act of March 3, 1879. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A.

Copyright, 1923, by the Modern Publishing Co.

The contents of this magazine must not be reprinted without permission.

H. J. Fisher, President; R. C. Wilson, Vice-President
O. B. Capen, Secretary and Treasurer



Blame Yourself

If This Message Doesn't Bring You A Big Salary Increase

LET'S be specific. What do you want in life? You want more money than you're getting. You want your own home, a car, membership in a good club, you want to wear good clothes, educate your children and put away enough money to make you independent. If you are like other men, you want to be your own boss in a position that grows every day in interesting fascination. You want to travel, see the world, and meet the wide-awake people who are doing things.

All right. I'll tell you a quick, easy way to accomplish all this. If you don't take it you are the only loser. You are the only one who will have to face the accusing finger of the man you might have been. If you do take it, you'll thank me the rest of your life for putting this information in your hands. For now it is possible for you to quickly enjoy bigger earnings, and have all the joys in life that your bigger self demands. If this was a guess I couldn't print it. I know it to be a certainty. It is proved by the cases of thousands of other men who have done exactly the same thing. Listen.

What It Brought These Men

Charles Berry, a farm hand of Winterset, Iowa, was offered this chance. He took it and jumped from \$18 a week to a position paying him \$1,000 the very first month. J. P. Overstreet, Denison, Texas, was on the Capitol Police Force at less than \$1,000 a year. He wasn't content with a bare living and he jumped to an income of \$1,800 in six weeks. F. Wynn, of Portland, Oregon, an ex-service man, wanted the joy of a real success. He earned \$544 in one week. George W. Kearns, working on a ranch for \$60 a month, took the quick road I offer you and in two weeks he earned \$524. Warren

Take one ten average men who are in blind alley jobs at low pay. Analyze each case without prejudice. You'll find that everyone of them is solely and entirely to blame for his poor earning power. Everyone of them has had a golden opportunity. They either have failed to recognize it, or, recognizing it, lacked the courage to follow it up. But now comes your chance. If this page doesn't bring you a big increase in salary—quick—you have no one to blame but yourself.

By J. E. Greenlaid

Hartle of Chicago was a railway mail clerk for ten years—in as deep a rut at as low an income as any man could stand. But he wanted success, he longed for the good things of life that he saw other men having. He took my advice and earned over \$7,000 the first year.

The Secret Is Yours

But, of course, you want to know how it's done. I'll tell you. Although none of these men had ever sold a thing in their lives—though many believed that a salesman must be "born"—a salesman—we took them, without experience or training of any kind and in a short period of time made Master Salesmen of them. Then our Employment Department helped them to select the right position and they were off with a boom to the success they had dreamed of.

The National Salesmen's Training Association can do exactly this for you. If this big organization of Master Salesmen and Sales Managers had raised the salaries of only a few men, then you might call it luck. But we've been doing it for fifteen years, day in and day out. Today we're so accustomed to the amazing increases in salary our members receive that we take them as a matter of course.

There is only one thing I ask of you in return for this offer. Don't let the idea of a big salary, the thought of traveling all around the country and meeting worthwhile people, make you think that the job is beyond you. Keep an open, unprejudiced mind on this subject—at least until you have

seen the remarkable book that I want to send you without charge.

Read This Free Book

This book, "Modern Salesmanship," explains why thousands have quickly succeeded in the selling field—how it is easy to make big money once you are in possession of the Secrets of Selling—how you can quickly get these fundamental secrets, apply them and achieve a quick and permanent success. This is the book I will send you, absolutely free of obligation and expense. Read it through and then decide for yourself.

But remember this one thing: This is your opportunity. If you don't realize a big salary increase from this message, you have no one to blame but yourself. Send me the coupon before you turn this page and I'll send "Modern Salesmanship" immediately.

National Salesmen's Training Association
Dept. 15-E, Chicago, Illinois

National Salesmen's Training Association,
Dept. 15-E, Chicago, Illinois.

I am willing to sacrifice the opportunity you offer without cost to myself. Please send me Free Proof that I can become a Master Salesman and qualify for a good sales position. Also send your illustrated book, "Modern Salesmanship" and particulars of membership in your Association and its Free Employment Service. This is all free of cost or obligation.

Name.....

Address.....

City.....State.....

Age.....Occupation.....

A Personal Letter to YOU



POPULAR SCIENCE MONTHLY

FOUNDED 1871

225 West Thirty-ninth Street, New York

OFFICE OF THE EDITOR

Service is the underlying policy of Popular Science Monthly. This policy will be exemplified in our June number, we believe, as in no other magazine ever published.

Doctor Royal S. Copeland, United States Senator from New York and former Health Commissioner of New York City, has posed especially for a series of photographs which will show you how to keep your self fit — and how to keep your body in good running order. It is an unusual pictorial article.

Jack Huns, famous radio expert, is preparing an amazing story promising a revolution in radio broadcasting. H. F. Blanchard, our automobile editor, will show how to handle the ignition and wiring problems which trouble every car owner. Henry Leonard, lightweight boxing champion, will explain in pictures the science of self defense.

Our Home Workshop Department will show how to make dozens of new and useful things for the home. In the Better Shop Methods section we will tell the mechanic how experts in his field save time and labor.

In this one issue of the most wonderfully illustrated magazine in the world there will be described more than one hundred new machines, processes and discoveries of science — all of which bring us one step nearer the common goal of happiness.

Popular Science Monthly brings science from the laboratory into the home. More than any other magazine it enables its readers to grow with the times. And — our June issue will be our best yet.

Anthony J. Blossom
EDITOR

POPULAR SCIENCE MONTHLY
225 West 39th Street
New York City

GENTLEMEN: Inclosed please find \$2.50 for a twelve months' subscription to POPULAR SCIENCE MONTHLY.

Name.....

Street Address.....

City.....

5-2-3

Newsstand sales of POPULAR SCIENCE MONTHLY are increasing so rapidly that some readers have found it difficult to obtain their monthly copies. Make sure of yours. Leave a definite order with your dealer or, better, subscribe today.



Use this NOW

Are You the Kind of Guest People Like to Invite?



SOME people always feel out of place at a dinner, or a dance, or a party. They are always constrained, always embarrassed. Others are so well-poised and at ease at all times—so able to mingle with the other guests and make themselves agreeable—that hostesses are eager to invite them.

Do you know all the little secrets of being a *likable* guest? Do you know what is expected of you on all occasions—how to make introductions and how to start interesting conversation after the introduction; what to wear to formal functions and to informal functions; how to make every one who comes into contact with you feel calm, at ease? The person with winning manners is always welcome. With the poise and dignity that good manners give, any one can quickly adapt oneself to every environment—can be at all times, with all people, cultured, impressive, well-liked.

Why Some People Always Feel Out of Place

HAVE you ever noticed, at any social function you may have attended, that bad manners instantly distinguish themselves? If a woman is embarrassed, constrained, ill-at-ease, every one knows at once that she is not used to good society.

If a man uses his fork in a clumsy manner, or makes incorrect use of the finger-bowl, he can not conceal the fact that he is ill-bred.

No hostess likes to invite to her home a man or woman she knows will make embarrassing mistakes. Those who are always blundering, always doing the wrong thing at the wrong time, are never welcome. They invariably make others feel uncomfortable in their presence.

But the person with winning manners is always welcome. He—or she—knows exactly what to say to the hostess on arrival, how to mingle with the guests, how to create conversation, how to be agreeable, how to do and say the right thing at the right time.

Do You Ever Feel Tongue-Tied Among Strangers?

At a week-end party, recently, one of the guests remarked secretly to the hostess that she had felt positively tongue-tied when she found herself at dinner among men and women she had never met before. "I just didn't know what to talk about," she said. "It made me feel stupid and embarrassed. Every one else seemed to be having such interesting conversations."

If she had known the important little secrets of social conversation, she would never have felt "tongue-tied." She would have known how to create conversation and how to keep it flowing smoothly, pleasantly. She would have known how to make herself agreeable, well-liked.

Do you ever feel tongue-tied at a party or a dinner? Do you ever wonder what to say after the introduction is made? Do you ever feel embarrassed, confused, stifled when you are among strangers?

The greatest value of etiquette is that it enables you to adapt yourself to every environment—gives you a sense of peace and security. It enables you to feel "at home" in all surroundings—to mingle with all people and feel entirely calm, at ease. It protects you from humiliation at the dinner table and in the drawing-room. It gives you a cultured, engaging manner that people recognize—and respect.

The Tell-Tale Marks of Bad Manners

There are so many little tell-tale blunders that one can make—as a guest, for instance. Do you know what to say to the hostess when you arrive? Do you know how to acknowledge introductions—whether the form

"How do you do?" is correct; whether one may say "Pleased to meet you?" Do you know the correct order of precedence into the dining-room? Do you know whether olives are taken with the fingers or a fork, whether the fork is held in the left hand or the right, whether bread may be bitten into or must be broken into small pieces as eaten?

When you leave, do you know what to say to the hostess? Do you know what is meant by the "bread-and-butter" letter? If you know exactly what to do, say, write and wear at all times, on all occasions, you will never be embarrassed.

The Book of Etiquette in Two Volumes—A Recognized Authority

Have you ever wondered how a home should be decorated for a wedding? What to serve at a luncheon? How to acknowledge an invitation?

Would you like to know why a bride wears white, why a teacup is given to the engaged girl, why black is the color of mourning?

Do you know how to word an invitation, what to wear to a theatre party, how to set the table for a formal dinner, how to register at a hotel?

Whatever you want to know you can find in the Book of Etiquette—the famous two-volume set that is today being used by thousands of men and women throughout the country. Weddings, parties, dinners, teas, dress, speech, correspondence—you will find complete details on every phase of conduct that interests you.

May we send you this famous two-volume set free for examination? You may keep the two books entirely free for 5 days and within that time decide whether or not you want to keep them.

This unusual plan enables you to see the Book of Etiquette in your own home and examine it before purchasing it. If you decide to keep the books just send us \$3.50 in full payment. If for any reason you are not delighted with them, just return them—and the examination will have cost you nothing whatever.

Send for the Book of Etiquette today. Take advantage of this free examination offer.

Nelson Doubleday, Inc.
Dept. 255, Garden City, N. Y.



Mistakes at the table distinguish themselves at once. Little blundering errors condemn a man or woman as ill-bred. Do you know all the rules of table etiquette?



Winning manners are more important than pretty clothes. Can you adapt yourself to every environment—make yourself always pleasant and well-liked?

NELSON DOUBLEDAY, Inc.
Dept. 255
Garden City, N. Y.

Without money in advance, or obligation on my part, you may send me the complete two-volume set of the Book of Etiquette. Within 5 days I will send you only \$3.50 in full payment or return the books. I am to be the sole judge of whether or not I want to keep the books.

Name.....

Address.....

☐ Check this square if you want these books with the beautiful full-leather binding at \$8.00, with 5 days' examination privilege.

(Orders outside of the U. S. are payable cash with order.)

Money Making Opportunities for "Popular Science" Readers



AUTOMOBILES AND ACCESSORIES

PATENTS—Write for free Illustrated Guide Book and Evidence of Conception Blank. Send model or sketch and description of invention for our opinion of its patentable nature. Highest references. Reasonable terms. Victor J. Evans & Company, 180 Ninth, Washington, D. C.

AUTOMOBILE owners, statisticians, mechanics, send today for free copy of America's most popular motor magazine. Contains helpful articles on overhauling, repairing, lighting, carburetors, batteries, etc. Automobile Digest, 333 Butler Bldg., Cincinnati.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

FORD ACCESSORIES

NEW Combination—Easy starting, saves gasoline. Adjusts automatic carburetor adjuster. \$2.00. Write: Sam Minor, 10411 E. Jefferson Ave., Detroit, Michigan.

BRIGHT Light and dimmer for magnets lighted Ford. Guarantee. Sample \$2.50. Bright Light, Box 304, Chicago, Ill.

SPENDING time—see "Red-4-Jet" on page 122.

FORD owners, don't ruin your car by having it shatter. Correct same by installing Brider's Ball Sides. Price \$1.10. Ask your dealer or write for information. Nio Brider's Ball Mfg. Co., Rock Island, Illinois.

WANTED

DETECTIVES—Excellent opportunity. Fascinating work. Experience unnecessary. Particulars free. Write American Detective System, 1088 Broadway, New York.

CASH for old gold, platinum, silver, diamonds, liberty bonds, war, thrift, United States stamps, lake south, magnets, points, jobs, any valuables. Mail to today. Cash sent, return mail. Goods returned in ten days if you're not satisfied. Ohio Smelting Co., 308 Hippodrome Bldg., Cleveland, Ohio.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 225 West 39th Street, New York.

DUPLICATING DEVICES

"MODERN" Duplicators save Time, Labor and Money. Copy Business. Reproduces Typewritten or Printed Letters, Drawings, Manuscripts, Music, Memo, Bills, Notices, Specifications, Maps or anything in one or more colors. Prints TWO per minute. Special sale 30 Days Free Trial. \$1.20 up. Booklet free. J. V. Dorchin-Reeves Co., Pittsburgh, Pennsylvania.

MISERABLE—Two Dollars. Stencil Printing. Typewriting—Handwriting. On Approval. Prime Specialty Co., 165 Princeton, Pa.

LABORATORY AND CHEMICALS

YOUR chemical problems solved and working process explained. Consultation Five Dollars. Write Mr. W. Medman Richards, Consulting Chemist, Box 2402, Boston, Massachusetts.

CONSULTING ENGINEERS

SCIENTIFIC Designs and Working Models of valuable inventions prepared and guaranteed. Consulting Engineer, 2 East 23rd Street, Room 714, New York.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

STEEL Problems solved. Practical. E. W. Brierley, Consulting Metallurgist, Wyomissing, Pennsylvania.

MANUFACTURING

We manufacture anything, design and build special machinery, develop inventions, build models, make drawings of every description, our facilities the best. Write for booklet. R. O. Clyde Engineering Co., St. Louis, Missouri.

MODELS, developing ideas and manufacturing my specialty. Absolute satisfaction, low rate. 33 years' experience. Write me first. H. Backer & Co., 984 Egan, Cincinnati, Ohio.

SPRINT made to order. Wright Bros., 6616 Huron St., Chicago.

FORMULAS

FREE—Formula catalog. Laboratories, 4600 Belmont Building, Chicago.

1,600 FORMULAS, recipes, trade secrets. \$24 pages. \$1.00. Humble Laboratories, 7021D South Winchester, Chicago.

FORMULA catalog free. C. A. Lutz, Apartment 241, York, Pennsylvania.

FORMULAS of the better sort. Write for our free catalog. National Scientific Laboratories, 213 North Monroe, Richmond, Virginia.

FORMULAS—All kinds. Catalogue free. Bestard Laboratories, 6047-PQ North Whipple, Chicago.

\$25.00 in PRIZES

To win one of these cash prizes is easy, and every reader is invited to enter this fascinating competition. Just write a letter of not over seventy words answering this question:—

What advertisement of "Money Making Opportunities" in this issue interests you most—and why?

Here are the prizes we will pay for the ten best letters answering the above question:—

First Prize \$10.00
Second Prize 5.00
Third Prize 3.00
And 7 Prizes
of \$1.00 each 7.00

First read every one of the "Money Making Opportunity" advertisements on pages 6 to 24. Check the ones that interest you. Then read over the ones you have checked and decide on the one that interests you most.

Then write a short letter, not more than seventy words, telling us why the advertisement you pick interests you most. Remember that ten prizes will be awarded. You have a good chance of winning one of them. Be sure to mail us your answer before May 1st. The prizes will be awarded, in the order of their merit, for the letters that are most interesting and best expressed.

The names of all the prize winners and the letters that win the first two prizes will be printed in this column in the July Issue. Address your prize letter to—

Contest Editor

POPULAR SCIENCE MONTHLY
225 West 39th Street, New York City

Here are last month's

PRIZE WINNERS

The First Prize of \$10.00 goes to Miss Margaret Detrich, 1110 Sixth Avenue, Juniata, Pa., for this letter:

Dear Sir:

The advertisement under Money Making Opportunities that interests me most is "Insects Wanted."

The reasons this interests me are as follows:

The study of insects would help in my Biology lessons.

It would be a pleasant pastime.

It would gain for me some extra money.

It would make me more popular with friends.

I could explain the insects to them on camping trips or on hikes.

Yours respectfully,

Margaret Detrich.

Casper Nathan, Garrick Theatre Building, Chicago, wins the Second Prize for the following letter:

Contest Editor:

The advertisement of the Metal Cast Products Company interests me most, because the writer uses enough words to tell his entire needs, instead of following the usual inclination to reduce a classified advertisement to a brevity almost meaningless (which frequently leads an advertiser to blame a medium for lack of results, when his own meagerness of expression is to blame).

The classification itself awakens patriotic pride in American manufacturing superiority.

Yours very truly,

Casper Nathan.

The Third Prize goes to J. R. Lounsberry,

4 Campbell Street, Bath, N. Y.

The winners of the other seven prizes are:—

E. J. Morrissey, Sterling, Ill.; Carl L. Reed, Des Moines, Iowa; D. E. McLain, Wilkes Barre, Pa.; Mrs. Mary Wilson, Brightwood, D. C.; Errol Moss, University Place, Nebr.; E. H. Elam, Crossville, Tenn.; Carl H. West, Washington, D. C.

Rate 35 Cents a Word. Advertisements intended for the July issue should be received by May 5th.

RADIO SUPPLIES

RADIO Holder for construction and repairing radio units. Three six-inch tubes 25c postpaid. Hamilton Lead Company, Hamilton, Ohio.

RADIO Generators: 500 volt 100 watt, \$23.50; high speed motors—Federal Phones, \$5.50. Battery chargers, \$12.50. Motor Specialties Co., Crafton, Pittsburgh, Pennsylvania.

LOUD Speaker for any Crystal Set. Hear music over entire house with Stetson's Amplifier, \$5.50; easily constructed by amateurs. Eliminating storage battery. Instructions complete. 25c. Catalogue free. Stetson's Wireless Mfg. Co., 580 Hastings St., Pittsburgh, Pa.

ADDING MACHINES

FREE trial, marvelous new adding machine. Adds, subtracts, multiplies, divides, automatically. Work equals \$350.00 machine. Price only \$15.00. Speedy, durable, handsome. Five-year guarantee. Used by largest corporations. Write today for catalog and free trial offer. Lightning Calculator Co., Dept. O, Grand Rapids, Mich.

TRADE SCHOOLS

EARN more money—Learn sign painting, scenic painting, stencil writing, auto painting, paper hanging, decorating, graining, marbling, at Chicago or at your home. Chicago Painting School, 157 West Austin Avenue, Chicago.

MOTORCYCLES, BICYCLES, SUPPLIES

DON'T buy a bicycle motor attachment until you get our catalogue and prices. Shaw Mfg. Co., Dept. 4, Oakbrook, Kansas.

PARTS for all motorcycles cheap. British Cycle Co., 1222 Westlake, Seattle, Washington.

New and Used Parts for all makes. Send for our prices. Kingshighway Cycle Co., 1108 North Kingshighway, St. Louis, Missouri.

AVIATION

THE American School of Aviation announces a new correspondence course in mechanics of aviation. A thorough training in practical aeronautical. American School of Aviation, Dept. 1744, 3601 Michigan Ave., Chicago, Illinois.

PROPELLERS for airplane propulsion, 5-foot diameters. \$12. 6-foot for Ford, \$18; others in proportion. Motorpropeller Works, 756, Ford Ave., St. Louis. Pictures free. Crawford Motor and Airplane, Long Beach, Calif.

INVENTORS desiring information write for our free Illustrated Guide Book and Evidence of Conception Blank, send model or sketch of invention for our opinion of its patentable nature. Highest references. Prompt service. Reasonable terms. Victor J. Evans & Company, 181 Ninth, Washington, D. C.

BOYS build model airplane at small cost. Write for circular. Aero Shop, 3030 Huron Ave., Detroit, Michigan.

MOTORS, ENGINES, MACHINERY

MOTORS: G. E. M. H. P., \$15.00; 1/2 H. P., \$20.50; 3/4 H. P., \$25.50. Generators: 8 volt 10 amp., \$15.00; 22 volt 500 watt, \$29.50. Write for Catalogue. Motors Specialties Co., Crafton, Pittsburgh, Pennsylvania.

1/2 HP Westinghouse motors, new, AC \$12.00 each. We buy and sell motors and dynamos of every size and description. R. Schelbert Company, 123 N. Third Street, Philadelphia.

CONCRETE Building Block Machine and Mold. Catalogue free. Concrete Machine Co., 207 South Third St., St. Louis, Mo.

AMERICAN MADE TOYS

MANUFACTURERS on large scale, also hobbyworkers, wanted to manufacture metal toys and novelties. Millions needed of barking dogs, wag tail pups, wild animals, automobiles, Indians, cow-boys, baseball players, canyons, toy soldiers, craning cranes, statues of Liberty, miniature castles of capital, bathing girl novelties and others. Unlimited possibilities. Guaranteed casting forms furnished manufacturers at cost price from \$5.00 up, with complete outfit. No experience or tools necessary. Thousands made complete per hour. We buy goods all year and pay high prices for finished goods. Cash on delivery. Contract orders placed with manufacturers. Catalogue and information free. Correspondence invited only if you mean business. Metal Cast Products Co., 1698 Boston Road, New York.

FOR BOYS

BO-LO roller bike ready to assemble. Boys are wild about it. \$2.00 postpaid. Norton Toy Co., North Easton, Massachusetts.

FISH Lure make fish bite fast. Box postpaid quarter. 3 boxes \$1.00. Union Supply, Warren City, Iowa.

MOUTH-ORGAN Instructor, 25c. Play in one hour. Elmer Publisher, Bowling Green, Ohio.

INSECTS WANTED

WHY not spend Spring, Summer and Fall gathering butterflies, insects? I buy hundreds of kinds for collections. Some worth \$1 to \$7 each. Simple outdoor work with my instructions, pictures, price-list. Send 10c (post stamps) for my Illustrated Prospectus before sending butterflies. Mr. Sinclair, Dealer in Insects, Dept. 7, Ocean Park, California.

See How Easily You Can Learn to Dance This New Way

If you can do the step illustrated in the chart in lower corner, there is no reason why you cannot easily and quickly master all the latest steps through Arthur Murray's method of teaching dancing right in your own home.

NO matter how skeptical you may be about being able to learn to dance by mail, this new course will quickly prove to you that you can easily learn without a teacher on the ground to direct your steps—and without music or partner—right at home.

Even if you don't know one dance step from another, these new diagrams and simple instructions will enable you to learn any of the newest dances in an amazingly short time. You don't need to leave your own room—it isn't necessary to go into a dancing class—or to pay large fees for private instruction. All you need to do is to follow the instructions as shown on the diagrams, practice the steps a few times to fix them in your memory and there is no reason why you should not be able to dance on any floor, to either band or phonograph music, and to lead, follow and balance correctly, no matter how expert your partner may be.

Learn Any Dance in a Few Hours

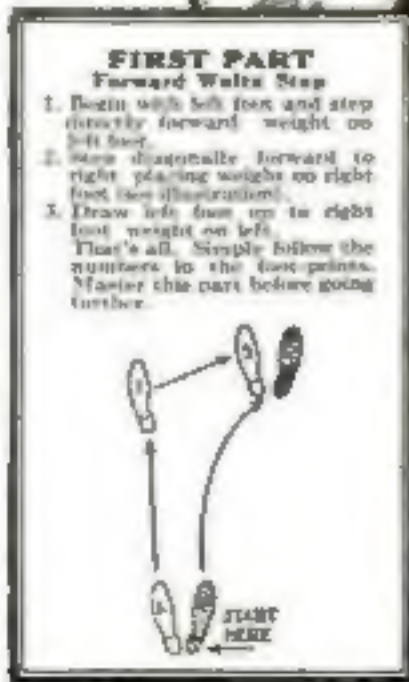
Whether you want to learn the Fox Trot, One Step, Waltz, or any of the newer steps, you won't have the slightest difficulty in doing so through this new method. Then, the very next time dancing starts you can surprise your friends by choosing a partner and stepping right out with perfect confidence that every step you make and every movement is absolutely correct. Arthur Murray guarantees to teach you, or your lessons won't cost you one cent.

More than 90,000 people have learned to become perfect dancers by mail, and there is no reason why 90,000 more cannot learn just as easily. In fact, about five thousand people a month are becoming wonderful dancers through Arthur Murray's

amazing new method.

Good dancers are always the most popular people in their set—they never lack partners and are invited to every social event because dancing is the most popular form of recreation, and good dancers are always in demand. But besides this, good dancers always have perfect mental and physical control, ease of manner, poise, are never embarrassed, shy or timid. Very often they meet influential people in this social way who are very helpful to them in business.

FREE: The Fascinating Tango



Four Horsemen," all just as we have explained it in this advertisement.

When your postman hands the special sixteen-lesson course to you, simply deposit only \$1.00 with him, plus a few cents postage, in full payment. Keep the course for five days. Practice all of the steps, learn everything these sixteen lessons can teach you and prove to your full satisfaction that you have found the quickest,



Courtesy Metro Pictures Corp.

Scene from the famous screen version of "The Four Horsemen," showing Rodolph Valentino in one of the wonderful Tango steps.

FREE Tango Lesson

Arthur Murray has diagrammed the principal steps in the famous Tango as danced by Rodolph Valentino in such a simplified way that you can quickly and easily master this fascinating Tango, after you have the Murray foundation to your dancing. Send for these Tango lessons today and you will soon be able to amaze all your friends with your ability to perfectly dance it.

easiest, and most delightful way to learn to dance. Then, within five days, if you desire, you may return the course and your dollar will be promptly returned to you. But if you decide to keep the course—as you surely will—it becomes your personal property without further payments of any kind.

Every month thousands of men and women are quickly learning to become fine dancers through Arthur Murray's methods of home instruction. There is no reason why you should not learn just as easily and quickly. This offer is made for a very limited time and may soon be withdrawn, so you must act quickly if you are to accept it.

ARTHUR MURRAY

Studio 731, 290 Broadway, New York

Arthur Murray, Studio 731,
290 Broadway, New York

To prove that I can learn to dance at home in one evening, you may send the sixteen-lesson course and the Three Fascinating FREE Tango lessons in plain cover, and when my postman hands it to me I will deposit with him only \$1.00, plus the few cents postage, in full payment. If, within five days, I decide to do so I may return the course and you will refund my money without question.

Name.....

Address.....

City..... State.....

Would You Like to Teach Dancing?.....

If apt to be out when postman calls you may send one dollar and we will pay postage.

GREER Trained Auto Experts Make Big Money

Earn \$50 to
\$125 a Week



Erwin Greer, President, has trained thousands for higher jobs—he can help you. GREER graduates, trained under his personal supervision, are making big money in all parts of the country.

GET ahead fast through GREER training. Big Pay—Fascinating Work—Unlimited Opportunities! Previous experience unnecessary. In eight weeks you can qualify as an expert Mechanic, Garage Foreman, Demonstrator, Battery and Ignition Expert, Auto Salesman, etc. GREER-trained men are preferred for the Better Paying Jobs.

**We Pay Your Railroad Fare to Chicago
Direct to Greer College**

This is **your** opportunity. Make a start **now** for the famous GREER COLLEGE—no matter what part of the United States you're in, get on the road to a Better Job while this offer of **FREE RAILROAD FARE** is open. Come to Chicago, America's wonder city, at our expense.

Automobile Business Is Booming

There is a demand for GREER-trained men. Increasing growth of Automotive Industry creates new jobs, new opportunities every day. Take the GREER course, then earn high pay as an Auto Expert.

Greer Course

The GREER Super-Course of Automobile Instruction covers the following subjects—all included in the complete course long experience has proved necessary:

Truck, Tractor and Automobile Repairing and Overhauling, Automobile Driving, Roadside Repairs, Primary Ignition, Vulcanizing and Tire Repairing, Electric Lighting and Starting Systems, Machine Shop Practice, Acetylene Welding and Cutting, Storage Batteries, Salesmanship.

Garage and Repair Shop Management, How to Get an Automobile, Truck or Tractor Agency.



**ERWIN GREER, President
GREER COLLEGE OF AUTOMOTIVE ENGINEERING**
I am interested in making more money and want you to send me your book—How to Succeed in the Automobile and Tractor Business—without obligation to me.

FREE BOOK

Free—our new 64-page book, "How to Succeed in the Automobile and Tractor Business." Just write your name and address on the coupon below and mail at once.

GREER COLLEGE

of Automotive Engineering

Don't wait—
Write at once—**NOW!** 2035 S. Wabash Ave., Chicago, Ill.



F. W. Tamblin, 437 Ridge Bldg., Kansas City, U.S.A.

"STAMMERING Its Cause and Cure"

You can be quickly cured if you stammer. Send 10 cents coin or stamps for 245 page cloth bound book on Stammering and Stuttering. It tells how I cured myself after Stammering and Stuttering for 20 years.

BENJAMIN H. ROGEE, 601 Bay St., 1141 N. St., Indianapolis

WANTED

Railway Mail Clerks
\$1600 to \$2300 Year
MEN—BOYS 18 OR OVER SHOULD
MAIL COUPON IMMEDIATELY
Steady work. No layoffs. Paid Vacations
Common education sufficient
Travel—See the Country.



Franklin Institute, Dept. R 221, Rochester, N. Y.
5c—Send me without charge: (1) Sample Railway Mail Clerk Examination questions; (2) List of Government jobs now obtainable; (3) Tell me how to get a Gov't job.

Name.....
Address.....

Money Making Opportunities

MODELS AND MODEL SUPPLIES

WE make working models for inventors and experimental work, and carry a complete stock of brass, iron and model supplies. Send for catalogue. The Model Works, Tinley Park, Illinois.

MODEL making and experimental work; modern shop, expert workmen. Manufacturing. Lampson Model and Experimental Works, 625 W. Jackson, Chicago.

Build your own, 1/2 to 1/4 horse power gasoline engines. Model steam machines horizontal or vertical. Blueprints at only one 50 cents. Order from ad. Stamp for circular. Master Model Co., Box 2128, Elgin, Illinois.

FOR THE HOME

GRANDFATHER clock works, 3501. Build your own case, instructions free. Make good profits selling your friends. Clock works with chains for old or new cases. Write for full particulars. Clock Co., Nictown, Pennsylvania.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

HOROSCOPES

HOROSCOPES showing talents, suitable occupation, ability, etc. Send 10c, birth date, 88, Germania Society, Shuysburg, Pennsylvania.

ASTROLOGY

ASTROLOGY reveals 25c, birth date and red stamp brings 2000 word trial reading. Two questions answered. Prof. Aubrey, Berlin Box 334, Washington, D. C.

OFFICE DEVICES

ADDRESSING machines, multipliers, duplicators, folders, check writers, rulers, dictating machines, at about half new cost. 17401, 170-2 North Wells, Chicago.

MISCELLANEOUS

MAKE interesting new friends through Jolly letters. Jolly Lee, Inc., 4254 Broadway, New York City. Stamp appreciated.

REARVIEW mirror light guides you in the dark. Write for details and get a Rearview Light Kit free. Stadium Application Co., Laboratories, 44 Paterson Street, Jersey City, New Jersey.

LEAD work for chemists and water. Pipe, tube and coil work of all descriptions. Tanks made to order. Experimental work. W. E. Kilmer, 1047a Fulton St., Brooklyn, N. Y.

5 POUND box of California fruits in any address \$2.50. Agents wanted. W. H. Patterson, 408 Furth Camp, Fresno, California.

CHARACTER—New scientific system of reading people. Write H. E. Conlin, Dept. C-1 81, John's Place, Buffalo, New York.

ADVERTISING

ADVERTISING—send display 100 magazines \$4.00, three issues \$8.00. Pennell Company, Covington, Kentucky.

ADVERTISING in 24 metropolitan dailies, 25 words, \$15. Ideal Guide listing 1000 publications, 4c stamps. Wade, Baltimore, Md., Chicago.

PARTIALITY pictures—make advertising pay! Warner Building, Marion, Ohio.

ADVERTISING—Your ad in 100 magazines for 4c per word. Sample free. Small Publishing Co., 1031 State Ave., Cincinnati, Ohio.

ADVERTISING art, copy, copywriting, written, designed and executed for big results. Martin-Gould Service, Kansas, Missouri.

ADVERTISING NOVELTIES

GILT lettered Advertising-Folders for you. Buy direct, save money. Miscellaneous goods. Samples free (no charge). Address R. Stumm & Co., 425 Walnut Street, Yonkers, New York.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

LANGUAGES

WORLD—Roman system, Masterkey to All Languages. Primers, 24 languages, \$1.34 each language: Arabic, Armenian, Bulgarian, Cantonese, Chinese, Danish, Dutch, English, French, German, Greek, Hungarian, Italian, Japanese, Latin, Persian, Polish, Portuguese, Rumanian, Russian, Swedish, Spanish, Swedish, Vietnamese, Yiddish, 94 languages. \$1.34 each language. 1—languages Publishing Company, 8 West 40th Street, New York.

LETTER SPECIALISTS

SUCCESSFUL, a few letters written for any business. Free details. Wierline Service Organization, Box 140, Fairview, Michigan.

MAILING LIST

GUARANTEED mailing lists of Addams and Ashland County, Ohio. Prices low. Immediate delivery. G. T. Shearer, Box 434, Ashland, Ohio.

FOR SALE

FOR sale—Cherry trucks (patent No. 1,317,711). Write Dora Bode, 303 East 15th Street, Austin, Texas.



These Are The Hours That Count

MOST of your time is mortgaged to work, meals and sleep. But the hours after supper are *yours*, and your whole future depends on how you spend them. You can fritter them away on profitless pleasure, or you can make those hours bring you position, money, power, *real success* in life.

Thousands of splendid, good-paying positions are waiting in every field of work for men *trained to fill them*. There's a big job waiting for you—in your present work or any line you choose. Get ready for it! You can do it without losing a minute from work, or a wink of sleep; without hurrying a single meal, and with plenty of time left for recreation. You can do it in one hour a day, right at home, through the International Correspondence Schools

Yes—You Can Win Success in an Hour a Day

Hundreds of thousands have proved it. The designer of the Packard "Twin-Six," and hundreds of other Engineers, climbed to success through I. C. S. help.

The builder of the great Equitable Building and hundreds of Architects and Contractors won their way to the top through I. C. S. spare-time study. Many of this country's foremost Advertising and Sales Managers prepared for their present positions in spare hours under I. C. S. instruction.

For 31 years, in offices, stores, shops, factories, mines, railroads—in every line of technical and commercial work—men have been winning promotion and increased salaries through the I. C. S. Over 180,000 men are getting ready *right now* in the I. C. S. way for the bigger jobs ahead.

Make Your Start Now!

No matter where you live, the I. C. S. will come to you. No matter what your handicaps or how small your means, we have a plan to meet your circumstances. No matter how limited your previous education, the simply-written, wonderfully-illustrated I. C. S. textbooks make it easy to learn. No matter what career you may choose, some one of the 300 I. C. S. Courses will surely suit your needs.

When everything has been made easy for you—when one hour a day spent with the I. C. S., in the quiet of your own home, will bring you a bigger income, more comforts, more pleasures, all that success means—can you afford to let another single priceless hour of spare time go to waste?

This is all we ask: Without cost, without obligating yourself in any way, put it up to us to prove how we can help you. Just mark and mail this coupon.

INTERNATIONAL CORRESPONDENCE SCHOOLS

Box 1234 G, Scranton, Pa., U.S.A.

Without cost or obligation on my part, please tell me how I can qualify for the position or in the subject before which I have checked on X

BUSINESS TRAINING DEPARTMENT

- | | |
|--|---|
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Industrial Management | <input type="checkbox"/> Advertising |
| <input type="checkbox"/> Personnel Organization | <input type="checkbox"/> Letter Writing |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Foreign Letters |
| <input type="checkbox"/> Building Law | <input type="checkbox"/> Foreign Trade |
| <input type="checkbox"/> Banking and Banking Law | <input type="checkbox"/> Penmanship and Typing |
| <input type="checkbox"/> Accounting (including T.A.) | <input type="checkbox"/> Business English |
| <input type="checkbox"/> Automobile Cost Accounting | <input type="checkbox"/> City Service |
| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Railway Mail Clerk |
| <input type="checkbox"/> Private Secretary | <input type="checkbox"/> International Subjects |
| <input type="checkbox"/> Dictation Keyboard | <input type="checkbox"/> High School Subjects |
| <input type="checkbox"/> French | <input type="checkbox"/> Illustrating |

TECHNICAL AND INDUSTRIAL DEPARTMENT

- | | |
|---|--|
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Architect |
| <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Blue Print Reading |
| <input type="checkbox"/> Mechanical Engineering | <input type="checkbox"/> Contractor and Builder |
| <input type="checkbox"/> Mechanical Draftsmanship | <input type="checkbox"/> Architectural Draftsmanship |
| <input type="checkbox"/> Machine Shop Practice | <input type="checkbox"/> Concrete Builder |
| <input type="checkbox"/> Railroad Practice | <input type="checkbox"/> Structural Engineer |
| <input type="checkbox"/> Gas Engine Operating | <input type="checkbox"/> Chemistry |
| <input type="checkbox"/> Civil Engineer | <input type="checkbox"/> Pharmacy |
| <input type="checkbox"/> Surveying and Mapping | <input type="checkbox"/> Automobile Work |
| <input type="checkbox"/> Metallurgy | <input type="checkbox"/> Airplane Engines |
| <input type="checkbox"/> Mining | <input type="checkbox"/> Agriculture and Poultry |
| <input type="checkbox"/> Steam Engineering | <input type="checkbox"/> Mathematics |

Name _____ Street _____

City _____ State _____

Please mailing in Canada send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada

ELECTRICITY

Will Pay You \$3500 to \$10,000 a Year

You, too, can learn to boss a big job like this and earn this big pay because—

Trained "Electrical Experts" are in great demand at the highest salaries, and the opportunities for advancement and a big success in this line are the greatest ever known.

"Electrical Experts" earn \$70 to \$200 a week. Fit yourself for one of these big paying positions.

Be an Electrical Expert

Today even the ordinary Electrician—the "screw driver" kind—is making money—big money. But

it's the trained man—the man who knows the whys and wherefores of Electricity—the "Electrical Expert," who is picked out to "boss" ordinary Electricians—to boss big jobs—the jobs that pay You, too, can learn to fill one of these jobs—spare-time only is needed. Be an "Electrical Expert"—earn \$70 to \$200 a week.

Age or Lack of Experience No Drawback

You don't have to be a College Man; you don't have to be a High School graduate. If you can read and write English, my course will make you a big success. It is the most simple, thorough, and successful Electrical Course in existence, and offers every man, regardless of age, education, or previous experience, the chance to become in a very short time an "Electrical Expert," able to make from \$70 to \$200 a week.



Some Features of My Course That Make SUCCESS Certain

1. Practical, Money Making Instruction—no theory.
 2. Payable in installments—no cash outlay.
 3. No need to quit your present job.
 4. Free Home Study Course—(No charge to get books, etc.—everything while studying or after work.)
 5. Free Engineering Materials—(Books, Tools, etc.)
 6. Free Home Study Course—(Books, Tools, etc.)
 7. Free Home Study Course—(Books, Tools, etc.)
 8. Free Home Study Course—(Books, Tools, etc.)
 9. Free Home Study Course—(Books, Tools, etc.)
 10. Free Home Study Course—(Books, Tools, etc.)
- These features are all explained in my Big Free Book.

I give you a real Training

As Chief Engineer of the Chicago Engineering Works, I know exactly the kind of training a man needs to get the best positions at the highest salaries. Hundreds of my students are now earning \$3,500 to \$10,000 a year. Many are successful ELECTRICAL CONTRACTORS.

Satisfaction Guaranteed

So sure am I that you can learn Electricity—so sure am I that after studying with me, you too, can get into the "big money" class in electrical work, that I will guarantee under bond to return every single penny paid me in tuition if, when you have finished my course, you are not satisfied it was the best investment you ever made.

Electrical Working Outfit—FREE

I give each student a Splendid Outfit of Electrical Tools, Materials and Measuring Instruments absolutely FREE. I also furnish them with supplies, including examination paper, and many other things that other schools don't furnish. You do PRACTICAL work—AT HOME with this Outfit. You start right in after the first few lessons to WORK AT YOUR PROFESSION in a practical way.

Get Started Now—Mail Coupon

I want to send you the "Vital Facts" of the Electrical Industry including my Electrical Book, Free Lessons, and a sample of my guarantee bond all FREE. These cost you nothing and you'll enjoy them. Make the start today for a bright future in Electricity. Send in the coupon—NOW.

L. L. COOKE, Chief Engineer

Chicago Engineering Works
Dept. 35 2150 Lawrence Ave., Chicago

Use this Free Outfit Coupon!

L. L. COOKE, Chief Engineer,
Chicago Engineering Works, Dept. 35
2150 Lawrence Ave., Chicago, Ill.

Dear Sir—Send at once the "Vital Facts" containing Sample Lessons, your Big Book, and full particulars of your Free Outfit and Home Study Course—all fully prepaid without obligation on my part.

Name _____

Address _____

City and State _____

Occupation _____

Age _____

The "Cooke" Trained Man is the "Big Pay" Man

You Can Earn Big Money in **RADIO** During Your Spare Time *Right in Your Own Neighborhood*

Hundreds of thousands of dollars were made in Radio last year! YOU can share in these profits—without even interfering with your present work. Read this remarkable Big-Money Spare-Time Plan! Like others who have already accepted our plan you, too, can earn \$5 to \$15 a day—extra money!

HOW would you like a steady, profitable spare time radio business of your own?—a business that can be conducted entirely on the side without conflicting with your present job? (right in your own home, if you wish)—a business which is a real pleasure, which can be easily started and yet quickly brings you big profits for your efforts?

You can easily have such a business right in your own neighborhood during your "off hours."

Radio—One of the World's Newest and Largest Industries

Radio, within the last few years, has swept the whole world. Today everyone is "listening in" on radio entertainments. Over two million radio sets are now in operation. Millions of dollars have been spent during the past year on radio outfits. The entire country has gone radio mad!

This is not just a temporary condition. Radio is here to stay. It is only in its infancy. Every day brings new developments in this field. More and more the public are relying on radio for their news, their entertainment, their education. Radio has a marvelous future—a future which lies far beyond our wildest imagination!

And like all new fields, Radio offers remarkable money-making opportunities to the far-sighted and ambitious. Thousands have already reaped big profits in radio. And as great as the opportunities are now, they will be far greater as the radio industry grows.

A New, Profitable Spare-Time Profession

In every city in the country right now, there is a crying demand for men who really know radio—not superficially, not just as a side line, but men who know radio from the ground up, who know all the ins and outs, who know the *Science of Radio*!

To such men there are endless opportuni-

ties for earning money. Their services are in constant demand. They are called on to install new radio sets, to repair old ones, to build special sets and parts, to demonstrate radio, to conduct radio laboratory tests, to entertain with radio—the list of opportunities for earning money open to such radio experts is almost limitless.

And now you can easily become one of these radio experts—a graduate Radio-trician. You can share in the tremendous rewards of this new wonder science.

How You Can Share in the Enormous Profits of Radio

Become a Radio-trician. No experience in electricity or radio is necessary. Spare-time study at home will quickly qualify you. The National Radio Institute has just perfected a new special course in *commercial radio*—a course which will enable you to cash in on the enormous demand for radio experts in your neighborhood.

In this course, prominent radio authorities give you, through the mail, personal instruction and advice. You are not only taught radio, but you are shown how to cash in on your radio knowledge—how to develop a steady profitable business of yourself.

And you don't have to wait a long time before you start earning—not even until you are thru your course. Before you are half-thru, you can begin to reap your share of the big radio profits in your town.

Send for New Spare-Time Money Making Plan

Probably never has there been such an unusual opportunity for ambitious men to earn money so easily in their spare time. Radio is an ever-increasing almost untouchable field—a field which offers much to

those who enter it now. Learn more about this wonderful plan for making spare-time money in radio. Mail in attached coupon for full details of this plan. Learn you can quickly become a Radio-trician by your spare-time at home. Get full information on the wonderful opportunities for making spare-time money. Mail the coupon today.

NATIONAL RADIO INSTITUTE

Dept. 12-E, 1345 Pennsylvania Ave., N. W., Washington, D. C.

These Men Now Earning Big Money in Spare Time Doing Radio Work

A few recent examples from hundreds of typical cases on record in our office of men who have completed our course:

Stanley Glasser, 18 years old, High School Student, just reported that he built and installed two receiving sets at \$450.00 total—profit \$150.00.

Scott G. Hopkins, of Newton, Iowa, reports having made \$100.00 during December putting up antennas and installing outfits in his direct neighborhood.

C. H. Holsenkrantz, Fort Meyer, Va., wrote us that he had established a radio department in a local electrical store where he gives demonstrations evenings and sells radio sets.

Henry Rucon states that he made \$1,600.00 in eight weeks, building radio sets up in the attic of his home during his spare time.

Matthew Waldron writes that in the past thirty days he made \$150, after high school hours, by selling, building, and repairing sets.

Men—Boys 18 or Over Should Mail Coupon Immediately

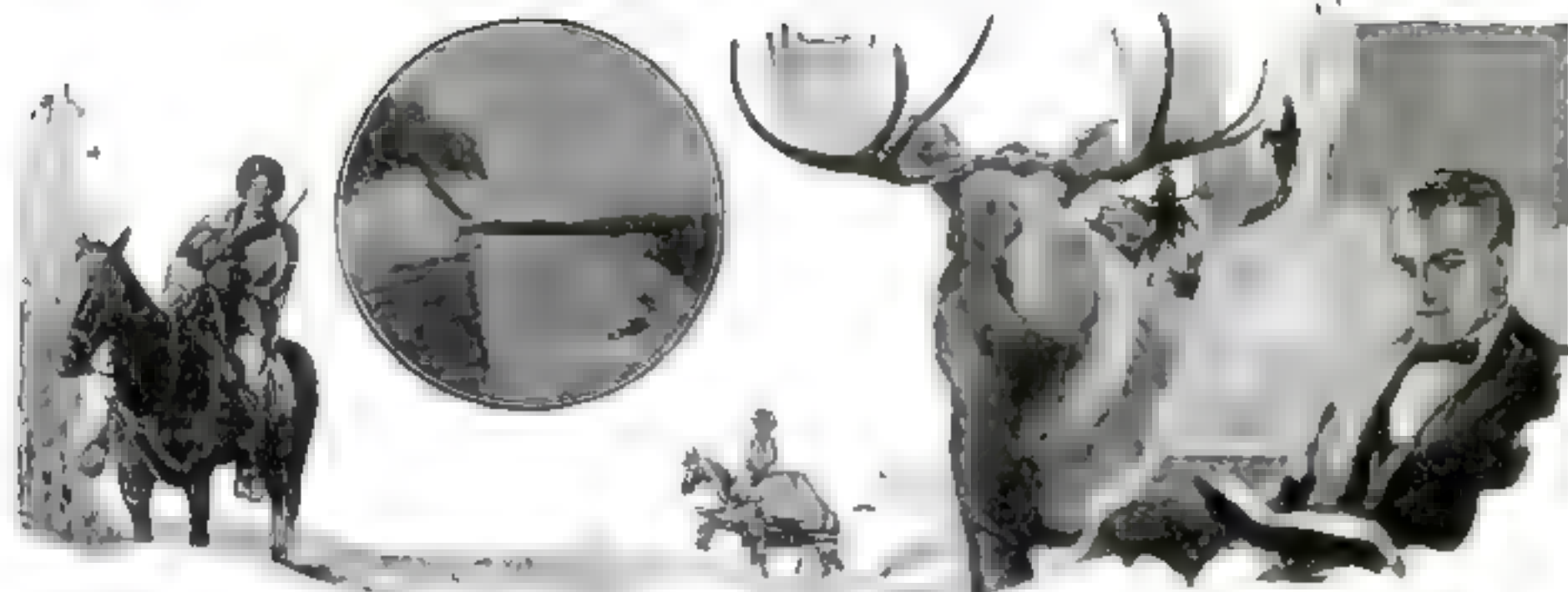
NATIONAL RADIO INSTITUTE
Dept. 12-E, 1345 Pennsylvania Ave., N. W.
Washington, D. C.

Please send me without obligation full information on your new course which teaches me how to build up a Profitable Business in Spare Time.

Name Age

Address

City State



Magic nights under the red moon

Though you sit in your cozy armchair you can still be out in the clean white spaces of the Northwest — out in Adventureland!

IF the hard pavements of the city streets are beginning to pall—if you feel hemmed in by tall, smothering buildings and the electric lights along the City Trail are beginning to lose their glamour—it is a sign that the "call of the wild" is coming to you. It is a sign for you to pack up your mind and follow James Oliver Carmichael in the great Romanceland of the Northwest.

Here is the great magic land where
care and worry are banished in a

twinkling—where the breath of Roman
stirs in the blood of men and women—
the and of adventite strange enchant-
ling, wondrous—stand under the great
open sky—gaze at the wondrous Red
Moon and the White Stars—hear the
cry of the wild pack—stand at the top
of the world and feel the spell of the
vast white wilderness—You do not
have to stir out of your easy chair to
do it. James Oliver Curwood is wait-
ing for you ready to carry you far and
happily into Adventureland.

JAMES OLIVER CURWOOD
6 Complete Volumes • Now at a Special Price

"Nomads of the North," "The Grizzly King," "Barce, Son of Karen," "The Courage of
Morre O'Donnell," "God's Country and the Woman," "The Hunted Woman."

To every soul there comes the frequent instant call of the wild. Your adventures begin with a fine satisfaction in exploring with James Oliver Curwood, the great Romanticist of the Northwest. Here in the enchanted country this great author writes about a amazingly wonderful adventures are a way happening. Let him take you along to the great white spaces of the wilderness. Spend the night with him under the frosty stars—travel over the great untrammelled spaces by canoe by snow shoe by dog sledge by on

Here waiting for you in the women's pages of *Janet Oliver Curwood's* book is all the magic Romance of a great and glorious country, read it at 15¢ and the life you live will be a clear and merry and calm and happy thing. The book can be bought at your drug store.

[illegible][illegible]

Send No Money

[illegible]

Nelson Doubleday, Inc.
510 1st Ave. S.W.
Garden City, N.Y. 11530

MONEY Nelson
Doubleday,
Inc.
Dept C-365
Garden City, N. Y.

[illegible]

5. 2. 1994

4.7.3. —

പിന്നെ

9516

If used in conj. with order deduct 50c.



A New Profession That Pays from \$3,000 to \$15,000 a Year!

An enormous untouched field. No competition. A tremendous demand. No capital required. Can be learned in from two to six weeks!

Do you want to get into something new where there is no competition and yet a big demand?

Do you want to be one of the early winners in a big money-making field?

Every man who looks back upon the past few decades in the industrial history of America can see at a glance that each new discovery of Science has brought into existence a countless number of new professions, each with their high-paid speciality.

New discoveries in the field of electricity, for instance, have created positions for specialists in electrical engineering, telephone and telegraph, radio and other branches too numerous to mention.

And now come about important discoveries in an entirely new field—discoveries which have brought into existence the need for men trained to a new profession which renders a great and appreciated service to the public and a service for which the public is willing and glad to pay high rewards!

In fact, men who are already practicing this new profession are making from \$600 to \$400 a week. And the profession can actually be learned and mastered in from two to six weeks.

Independence Without Capital

To the man who wishes to become established in a profitable business of his own but who has not the capital or financial backing usually required, this new profession offers a limited opportunity. This is because you become affiliated with a strong Association Headquarters in New York City, which trains you in the profession, finances you after graduation, makes you its representative in your community, and keeps in constant touch with you, giving advice and business cooperation.

Furthermore, this new profession offers its followers a position of dignity and independence, a free rein for initiative, and those other recognized advantages enjoyed only by professional men. Yet there is no long period of training and study, extending over years, no poorly paid period of apprenticeship, as in the case with doctors, lawyers and followers of the old-time professions. And best of all, there is practically no competition!

This is one reason why those men who are now practicing this new profession are actually making more money than the average doctor, lawyer, architect or engineer!

Why Such Opportunities Are Possible

The idea back of this new profession is briefly this:

It is conservatively estimated that over \$300,000,000 property loss is occasioned annually from insects and rodents that infest offices, ships, warehouses, private homes and buildings of all kinds. Then, too, there is the annual loss to crops and to live stock and poultry, due to the ravages of plant parasites and pests of all descriptions, which is so great as to be almost beyond calculation.

What has been done to combat this damage to private and public property caused by these parasites of the insect world?



U. S. Department of Agriculture and Forestry, whose skilled entomologists and sericulturists have waged war on the Cotton Moth, the Boll Weevil, and other national insects.

The private individual has been left to his own resources. Property owners, farmers and householders have had to rely upon ineffective commercial preparations. With few exceptions these "sprays," "insecticides" and "powders" are worthless in meeting conditions.

The scientific exterminating of insects, vermin and parasites is a highly specialized work. It demands a knowledge of technical methods and special formulas. Until recently these methods and formulas were unknown. But Modern Science has discovered secret formulas, has devised accurate, well-defined plans and methods by which crops, trees and private property can now be saved from damage, destruction and contamination with the same degree of certainty and safety as germs and infection are exterminated by the skilled methods of the physician and surgeon.

These new discoveries in the field of Exterminating Engineering have created a tremendous demand for men trained to this work of sanitation and public service. Those who have already taken advantage of this new field of opportunity are highly respected professional men in their communities. And their earnings are equal to, or even greater than the average remuneration received by experts in other professions.

Profits Come Quickly

Exterminating Engineers have no difficulty in getting business. The work is so important and so known that they can get it without any effort. Farmers and householders are glad to pay large fees for having their premises freed from the ravages of destructive pests and parasites. This work in Exterminating Engineering pays from \$600 to \$3000 in only a week's time.

But the man who enters this new and lucrative profession is not dependent solely upon his individual efforts.

The Exterminating Engineers of America—a co-operative organization whose membership consists of men practicing in all sections of the country—Headquarters in New York City—where they train men by mail and graduate them into two classes: as Exterminating Engineers. Then they help find for them in business, appointing them their representatives in their own communities. No capital is

required. The purpose of the Exterminating Engineers of America is to furnish the world with the most efficient and economical means of exterminating insects, vermin and parasites, and to provide a great and humanitarian service to mankind.

The Backing Of a Big Organization

A national organization, which is now being formed, will train an American public of the work of sanitation with the Exterminating Engineers of America as its only ally. This ally will give you the support and backing of the biggest business in the world, and with the backing of the U. S. Government.

Exterminating Engineers of America are always in demand for their services. They are the only men who can actually become established in business of this kind, as an Exterminating Engineer, as a great source of money than the average business man has to pay for test books and supplies alone.

Send For This Free Book

Full information about the opportunities of Exterminating Engineering will be sent you of charge to any man who requests. Ask for our Free Book.

A Profitable Business Over Night, which describes the unique advantages of becoming established in business of this kind, as an Exterminating Engineer, as a great source of money than the average business man has to pay for test books and supplies alone.

Send your name and address on a postcard asking for our FREE Book, "A Profitable Business Over Night." Address: Dept. 25, Exterminating Engineers of America, 43 West 10th Street, New York City.

**Exterminating Engineers of America
Dept. 25, 43 West 10th Street,
New York City**

Please send me without obligation, your Free Book, "A Profitable Business Over Night," which tells how I can earn from \$5,000 to \$15,000 a year as an Exterminating Engineer.

Name _____

Address _____

Has a Remedy for Baldness Been Discovered at Last?

Famous Merke Institute in New York Uses New French Method
Which Has Now Been Adapted for Home Use With Amazing Results

AT the Merke Institute on Fifth Avenue, New York, you will see every day scores of men and women, once bald or troubled with thin, falling hair, who now possess beautifully thick, luxuriant hair that is the admiration of all their friends.

These men and women were saved from the humiliation of baldness by a new European discovery—a discovery which works on a simple natural principle, but which is bringing results that would seem nothing short of astonishing.

Formerly this treatment was within reach of only the very wealthy. But thanks to an ingenious invention, the very same results for which many have paid as high as \$1,000, is now available to everyone—in their own homes, and at a cost of *only a few cents a treatment!*

For centuries the subject of baldness has been one of deep interest to the scientific world. Countless theories have been advanced as to how hair could be made to grow and just as many theories have been discarded.

Eventually, the general scientific belief became that baldness was incurable—that there was nothing in the world that could make hair grow, once the head became bald.

The belief held until 1910, when a series of new experiments were started by a group of well known French investigators. These were conducted on an entirely new line of thought. Indeed, they were such a distinct departure from any previous experiments, that at first they were laughed at.

Despite many discouraging drawbacks, this line of investigation was continued until recently, when it was announced that the experimentation had at last proved successful. For a treatment had at last been perfected which would not only positively stop the falling out of hair but which, in the great majority of cases, would actually grow hair on heads *that were even completely bald!*

When the hair falls out it does not necessarily mean that the hair roots are *dead*. For it is now a matter of scientific fact that in most cases of baldness the hair roots are simply *dormant*, and if properly stimu-

lated, *can be made to grow hair again!*

Ordinarily hair tonics and foods cannot reach the hair roots, which are embedded deeply in the scalp. That is why these methods are so often ineffective in restoring hair. It has been found that the only possible way of stimulating the hair roots to activity is by properly *opening the pores*—then feeding the roots. And this, it has been proved, can be done effectively only through the application of a special kind of gentle, soothing heat.

At first the only way in which best results could be secured was by using a very expensive apparatus. That is why these treatments were so expensive. Now, however, these same results can be had at an astonishingly small cost. This is through the home treatment given by the Merke Institute which is known as the Merke Thermocap Treatment.

The Thermocap Treatment is entirely different from anything known or used before. It can be used in any home in which there is electricity.

It was perfected by Prof. Alois Merke, a dermatologist of international reputation and founder of the now famous Merke Institute.

So remarkable have been the results secured by Prof. Merke through his system that people come to him from all over the country to receive the benefits of this new discovery. Among Prof. Merke's patients are numbered many stage and social celebrities, and the results that have been secured are in many cases nothing short of astonishing.

People who have been bald for years—many of whom were *completely bald*—now possess beautiful, thick hair, without even the slightest suggestion of "bald spots." Such ailments as dandruff, itching scalp, falling hair—these have in every case quickly disappeared under the seem-

ingly miraculous influence of this new method of treatment.

The Merke Thermocap Treatment is positively guaranteed to stop the falling out of hair—to cure dandruff, and to stimulate the growth of hair on bald or semi-bald heads provided, only, of course, that the hair bulbs are still alive and (as in the case of most types of baldness) are simply dormant. If, within thirty days, you are not more than delighted with results, the small cost of the Thermocap Treatment will be refunded instantly.

So many thousands of people have regained thick, luxuriant hair through the Thermocap Treatment that if you are at all bald, or if your hair shows signs of falling, you owe it to yourself to investigate at least, this remarkable new method of growing hair.

A vitally interesting booklet, describing the Merke Thermocap Treatment in detail, will be sent you entirely free of any cost if you merely fill out and mail the coupon below.

No matter how long you have been bald, no matter how many different treatments you have taken without results, this booklet will prove to be of deepest interest to you. So send for it today. Merely mail the coupon below, and it will be sent you by return mail. ALLIED MERKE INSTITUTES, Inc., 512 Fifth Avenue, New York City, Dept. 175.

Marvelous Increase in Growth

After three weeks of your treatment I notice the most marvelous increase in the growth and thickness of my hair. I have consulted most of the noted specialists in America and Europe and I have found none to compare with you. It gives me just the satisfaction and quick results I was looking for. American News, Hartford.

Growing Rapidly

My hair is growing so fast that each time I wash I am running a race with its length and speed to see who will get there first. Miss A. M. S., New York City. (This woman, before treatment, was completely bald.)

Absolutely Wonderful

"Splendid are the results noticed since your treatment of my scalp began. It is absolutely wonderful. My everlasting thanks to you." Lieut. Col. P., Washington, D. C.

(The above excerpts are typical of hundreds of letters received by from delighted users of the Merke Institute Treatment for Baldness and Falling Hair.)

ALLIED MERKE INSTITUTES, Inc., Dept. 175
512 Fifth Avenue, New York City

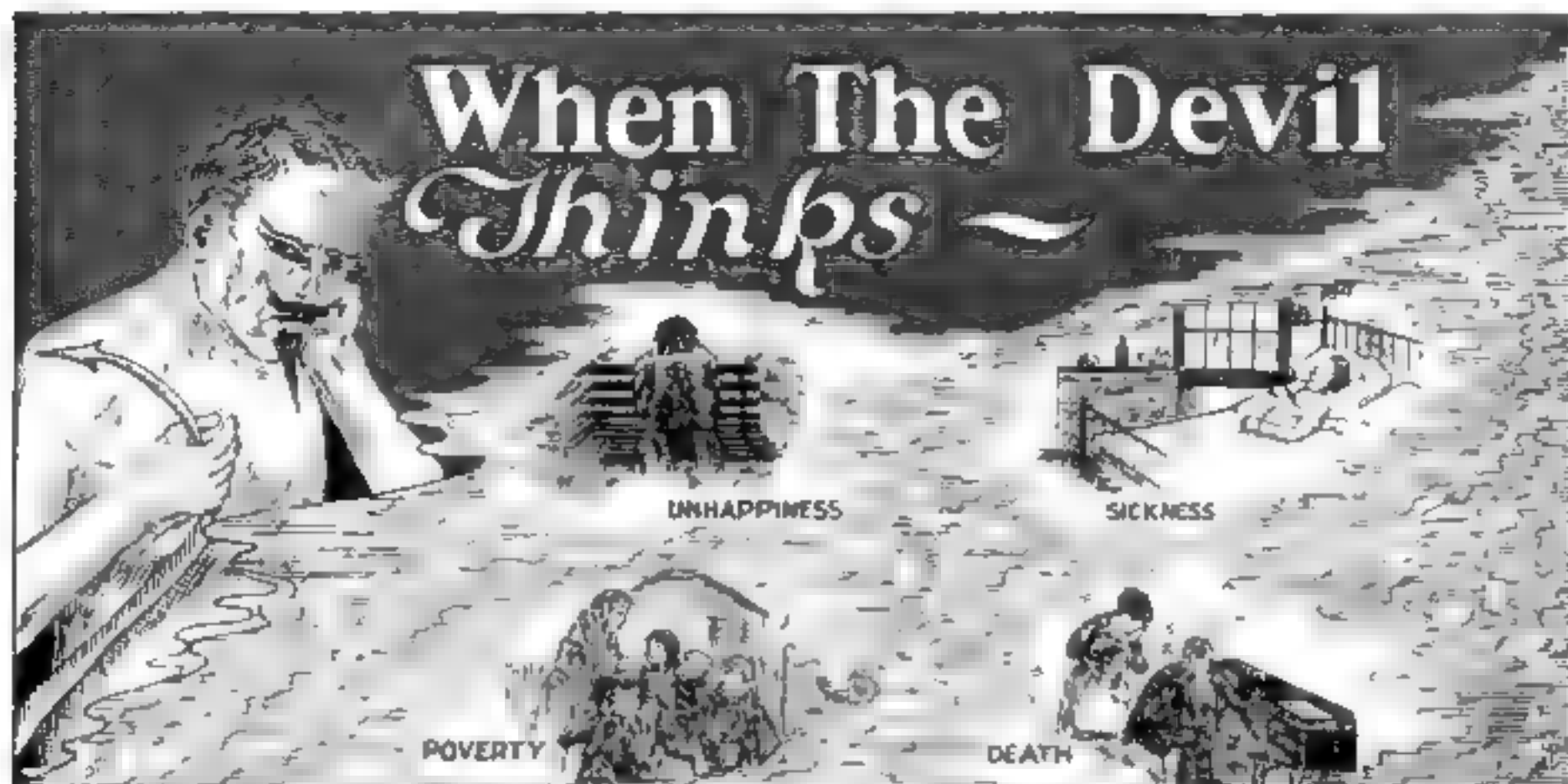
Please send me, without cost or obligation on my part, a copy of the new booklet describing in detail the Merke Thermocap Treatment.

Name _____

Address _____

City _____

State _____



If the Devil Wished to Serve You the Very Worst Possible Turn, He Could Ask Nothing More Than an Opportunity to Do Your Thinking For You

In that way he could quickly rob you of your health, destroy your prospects of success, reduce you to poverty, cheat you of love, plunge you into unhappiness, and send you down prematurely to the grave. He would not have to think vicious or immoral thoughts in order to do these things, but merely the *wrong kind of thoughts*.

You may believe in the existence of a personal devil, or you may not. If not, you at least realize that the devil is an allegorical personification of evil. Regardless of your beliefs in this respect, it is solemnly and terribly true that

You May Play the Devil

yourself by thoughts and states of mind, that will be just as destructive to your health, success and happiness as any thoughts that a personal devil might think for you. If you are not abundantly well, successful and happy, you are playing the devil by your way of thinking.

On the other hand, it is easily within your power to assume a method of thought and an attitude of mind that will make you free from disease, failure, disappointment and unhappiness, and that will bring you into possession of whatsoever things you desire: money, health, success, honor, renewed youth, love and happiness.

A wonderful new thing has happened in the world. The great physicians and psychologists of modern science have found that each human being has within him an inexhaustible supply of wisdom and power, and that he can easily draw upon this supply for the

destruction of everything he does not want, and for the acquirement of everything he does want. Tens of thousands of men and women have already accomplished these things.

Although my time is largely taken up by my duties as one of the judges of the highest and most important trial courts in my state, I have made an humble contribution toward this great discovery, and you may have heard of me through some of my writings or lectures.

The Liberating Truth Is Free

REGARDLESS of whether you have ever heard of me or not, I have written a personal message for you, which I will be glad to send postpaid and free of charge. It is entitled "Realization." It will introduce you to your own really wonderful self, tell you all about your indwelling wisdom and power, and set your feet upon the way of success, health, love, liberty and happiness. The truth contained in this message has brought me such rich blessings that I feel I ought to tell others about it, and I set aside a few hundred dollars each month for that purpose. Remember, it is

Absolutely Free of Charge

If you want it, just fill out and send to me the little coupon at the bottom of this page, and it will go forward by return mail.

Daniel A. Simmons,
Jacksonville, Florida

DANIEL A. SIMMONS,
105 Law Exchange Building, Jacksonville, Fla.

I accept your offer to send me, free and postpaid, your message entitled "Realization," with the understanding that by accepting it I incur no obligation whatsoever.

Name

Street Address, ...

City

State

P. S. 5-23

THEY SAY—Comments of the Month by Men of the Hour in Science

DR. PERCY STICKNEY GRANT

Rector of the Church of the Ascension, New York City, who boldly has faced the issue of harmonizing the church with modern science:

"I WOULD much rather be the bright son of a peasant than the degenerate son of a duke, and I would much rather be on the upgrade from an ape than on the downgrade from Adam. And it makes a



Dr. Percy Stickney Grant

great deal of difference to our religion which ideas we have; whether we think we are all laboring for higher and higher human evolution, or whether we are rolling in the dust and complaining of that story of Adam and the apple and poor Eve

"We at least have the right to disencumber our minds from those ancient theories of creation and thought of God and these myths as to how man came into the world and where his troubles came from. It goes without saying that we have got to disencumber our minds of a great deal of the material that lies at the basis of ordinary theology today

"What we want to do is to make the foundations of religion firmer and put those foundations right where the young people understand and see them—on science."

EDWARD B. CRAFT

Chief Engineer, Western Electric Company, speaking at a recent meeting in which two large audiences, separated by nearly 1000 miles, listened to the same addresses by radio:

"THE loudspeaking telephone system will tend to reestablish oratory by making it possible for the nation's leaders to sway great audiences."

DR. HUDSON MAXIM

Scientist and inventor, speaking before the National Cotton Conference for Boll Weevil Control:

"IT MIGHT be worth while to try the use of a lure made from the female moth of the boll weevil as a bait for catching males or in leading them to sip poison. Smell is the guiding sense of insects in the discovery of their mates

"Experiments with flies, moths, and other insects show they are provided with very highly developed olfactory organs, which give them a keenness of scent that would shame a hound. They appear to have a sort of radio sense.

"It was demonstrated by experiment with silkworm moths that the male moth can smell the female at a distance of two miles.

"The boll weevil lure might be made with the use of a preparation made from the entire insect or some sort of fluid extract. It might be possible to discover some solvent that would dissolve only the aroma secretions of the female moths."

BENEDICT CROWELL

Former Assistant Secretary of War, and now one of the directors of a proposed dirigible air service between New York and Chicago:

"IF THE Germans had helium, the story of the Zeppelin in the war would have been different

"Helium is contained in certain natural gases, especially in Texas, and we have spent large sums in developing processes for its separation. Progress has been made, and today we are able to produce helium in considerable quantity

"We expect great improvement due to recent certain inventions. We have, therefore, continued our interest in dirigible airships for commercial use."

THOMAS A. EDISON

"A GREAT field for invention is the heavier than air machine that goes straight up. James Gordon Bennett once gave me \$1000 to experiment. I made a machine that weighed only 80 pounds, but it did not do the trick. I scorched my hands and burned most of the hair off my head trying to perfect it, but I didn't. There is a great field for the helicopter."

DR. CHARLES F. STEINMETZ

Chief consulting engineer of the General Electric Company:

"THE biological engineer may enable the world to support many times its present population by producing energy crops and by feeding the human race on proteins produced by microorganisms.



Dr. C. F. Steinmetz

What an advantage we should have by developing or creating new species of microorganisms that reproduce at an economically rapid rate! We have done much in producing new plants, but each generation takes about a year; but in microorganisms we may have a generation a day or several generations.

"In our time we have seen the sugar beet doubled in size and sugar content by the application of scientific methods. Working in the same line with other plants, probably fast growing grasses, why would it not be possible to breed a type of vegetation that might be called an energy crop, fixing solar energy on a large scale?

"Within a century or two, or even a shorter time, we could supply the world with food, not through cultivation of new areas for the growing of wheat, but by producing it through microorganisms without depending upon sunlight."

LEE DE FOREST

Noted radio pioneer and inventor.

"UNDOUBTEDLY, the folds where a poor boy starting out by himself can carry on inventive research unassisted by well-equipped laboratories of large corporations, are extremely limited

"In this respect radio offers exceptional advantages. Research work in many of the



Lee De Forest

departments of the radio field requires comparatively small and inexpensive laboratory equipment. I would mention particularly the problem of static elimination on which so many radio experts have labored more or less unsuccessfully for the past 20 years.

"A simple and reliable calling device for radio receivers that can be manufactured and installed at low cost, offers another attractive problem."

PROFESSOR WILLIAM STARR MYERS

Department of History and Politics, Princeton University:

"OF 106,000,000 persons in the United States, statistics show that 45,000,000 are subnormal and never would have even the mentality of a child of 13; 15,000,000 are feeble minded and their brain power forever would be that of a child of eight. Of the remaining 45,000,000, at least 25,000,000 are classed as mediocre; 5,000,000 are rated as Class A in mentality, and 15,000,000 as Class B

"Class A and Class B do the work of the citizenship of the country."

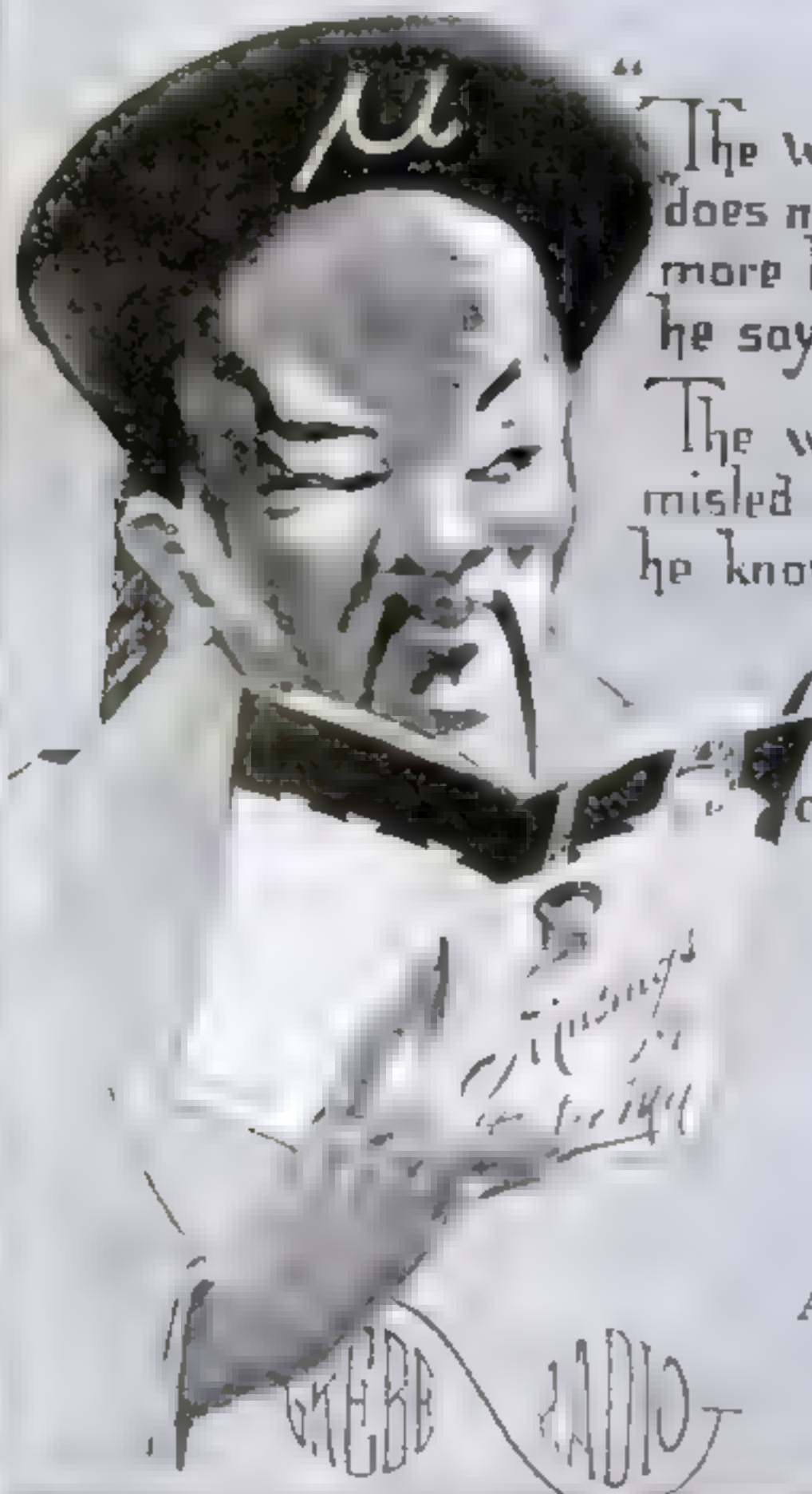
PROFESSOR FREDERICK J. ROGERS

Of the Physics Department, Leland Stanford, Jr., University, whose body accidentally came in contact with a 3000-volt electric current—a voltage usually used for electrocution:

"ELECTROCUTION is an entirely painless method of inflicting death. It knocked me cold. I never had a pain or a pang—in fact, never knew what happened to me until I was revived 15 minutes later

"I can't describe how it seems to be dead, for I have no recollections of any sensations until I was revived.

"Death in electrocution is usually caused by stoppage of the heart. Sometimes stoppage of respiration causes asphyxiation."



"The wise man," said Confucius, "does not esteem a person more highly because of what he says. —"

The wise radioist is not misled by extravagant claims, he knows that only a

Grebe Receiver

can come up to his expectations.

Doctor Mu.

A. H. GREBE & CO., Inc.
Richmond Hill, N. Y.

Western Branch
454 East 3rd Street, Los Angeles, Cal



Write for
"Musings of
Dr. Mu"



Is Rainmaking Riddle Solved?

Amazing Success of Fog-Blasting Airplanes Brings New Attempt to Produce Heavy Rainfall by Spraying Storm Clouds with Electrically Charged Sand

By Manus McFadden

OF ALL the marvelous achievements of modern science there is none that offers more dramatic possibilities than the recent amazing demonstration of two scientists who claim to be able to make, at will, rain, by precipitating clouds, or sunshine, by dispelling fogs.

Dr. Wilder D. Bancroft, professor of physical chemistry at Cornell University, and L. Francis Warren have actually succeeded in annihilating clouds and precipitating snow by spraying them with electrically charged sand at McCook Field in Dayton, Ohio. Their efforts, unlike those of other experimenters, have been based on chemistry rather than meteorology.

What It May Mean

Think of it!

Rain when you want it. Sunshine when you want it. Los Angeles weather in Pittsburgh and April showers for the arid deserts of the West. Man in control of the heavens—to turn them on or shut them off as he wishes.

It seems incredible. But if experiments so far successfully carried out fulfil their promise, it will be a scientific reality of tomorrow. Its application to everyday life is now considered by eminent meteorologists only a matter of time.

Farmers who have prayed for rain as they watched moisture in the form of clouds from early pass over their heads; ship owners who have been worried and harassed by fogs; dwellers in the arid desert and those living in misty lowlands; residents of smoke-shrouded cities in the denser centers of population; in fact, persons in every walk of life, are watching eagerly for further developments in the experiments of Doctor Bancroft and Mr. Warren.

Public Was Skeptical

So many quacks have advanced theories and apparatus for making rain in the past century that scientists and the public have come to look askance at any attempts at rainmaking. But never before has a process been put for-

ward with such reliable scientific backing.

A dramatic picture of one of the experiments carried out at McCook Field is drawn by Orville Wright, famous as a pioneer in aviation, an eyewitness.

"While at work in my office one day," he said, "my attention was attracted by the peculiarity of the sound of an airplane overhead. On looking out of the window I saw the plane just entering a dense white cumulus cloud. It completely disappeared from view, but 10 or 15 seconds later it emerged from the opposite side.

"When it emerged, I noticed it was

leaving a long trail of what appeared to be smoke in its course, but on further observation, I discovered the trail was dust being discharged from beneath the airplane. I then recognized it as one of Doctor Warren's experiments, of which I had already heard.

After the airplane had passed through the cloud five or six times, the cloud began to fade away, and at the end of three or four minutes had practically disappeared. The airplane then entered a cloud that was lying at the left of the first one. After the plane had passed through it several times, this cloud began to fade rapidly.

"The plane then flew to a third cloud. Within about ten minutes from the time I first saw the plane, the three clouds had entirely disappeared. I did not observe any precipitation while the clouds were disappearing."

How Fog Is Dispersed

Within six months Bancroft and Warren expect to complete further experiments that will establish in the minds of the skeptical the practicability of their process beyond the shadow of a doubt.

The fog dispelling operation is comparatively simple. Briefly, pulverized sand is carried above the clouds by airplane, the sand is electrically charged as it issues from nozzles, and is sprayed on the cloud. The sand causes particles of moisture to coalesce, or combine, until the tiny drops form one big drop heavy enough to fall.

Doctor Bancroft explains that clouds consist of drops of water too small to fall under the pull of gravity.

Electrically Charged Sand

"Drops of moisture in the clouds are kept from coalescing either by being charged electrically and therefore repelling each other, or by being covered with a thin film of condensed air that acts as an atom capsule," he says. "By spraying with positively charged sand, the drops will cause the moisture to move toward the sand, and the drops will coalesce and fall."



Spraying cloud banks with electrified sand, the balloon cuts a path of clear atmosphere to earth.



How scientists propose to manufacture clouds and rainfall. The first plane, trailing sparking antennae, condenses the cool and moisture laden air into a cloud by scattering electric charges. The second plane turns this cloud into rain by spraying it with electrically charged sand.

them many of the finer drops, just as the coarser particles of butter fat in milk carry up many of the finer ones when cream rises.

"The new process sprays electrically charged sand from above, and the thicker the cloud the more rain will be produced with the same amount of sand. Experiments at McCook Field show that with 80 pounds of sand charged to 15,000 volts, a cloud covering two square miles can be dissipated in less than ten minutes. Much better results are expected with sand charged to 30,000 volts and with a more efficient charging nozzle.

Captive Balloon Clears Flying Field

"Experiments so far have been made in cooperation with the Army Air Service to demonstrate the feasibility of removing fog from flying fields. Experiments to be made at Moundsville, W. Va., will use a captive balloon 1000 feet up to spray sand and clear the field. It can certainly be kept in the air for a considerable time and can be brought down at will.

A flurry of snow followed the spraying of a cloud with charged sand. Since then a great many test flights have been made and no cloud has been able to resist the sand-blast attack made upon it.

In addition to dissipating existing clouds, the scientists hope to clear the atmosphere of large smoky cities. They propose to do this first by creating fog clouds by charging the moisture laden atmosphere with electricity and then using the sand blast to precipitate the clouds thus formed. To condense the foggy atmosphere into clouds they propose to produce negative charges in the atmosphere by means of electric sparks issuing from a multitude of wire antennae trailing from the plane. The ensuing process of dissipating the clouds so formed is by spraying the negatively charged droplets with positively charged sand, thus causing the two to combine and form huge drops.

If the process can be carried out on a large scale and cheaply, its great future will be economic. If it can water sections of the country threatened with drought, if it can make the desert bloom, the discovery may eventually change geography and history, remake the maps of the world and alter the future of the human race.

It may take its place as one of the greatest scientific discoveries in the history of the world, with effects as far-reaching even as the telephone, radio, the steam engine and the automobile.

Think what man-control of the weather will mean to the farmer! Visualize hundreds of airplanes flying high over parched sections of the country. The rain clouds that ordinarily would pass by, carrying their moisture with them, are attacked. Down comes the rain. Gasping acres receive it and millions of dollars are added to the value of the crops.

Think of the time to be saved by steamships entering our harbors. With sand-blasting airplanes cutting the fog away,

these ships could make their docks without delay, saving enormous sums.

Consider a naval battle off our coasts with the safety of the nation depending on prompt action by our battleships. A fog comes rolling in from the sea. The big guns are powerless because their targets have been obscured. The airplanes with their charged sand hop off the decks of the ships and dispel the fog, revealing the enemy.

Would Drive Away the Gloom

Take an army, helpless in the field while fog-protected artillery bombards its positions. Airplanes again would come to the rescue, dispelling the fog and revealing the hidden guns.

Such a discovery has a psychological value—an application to every-day life.

How often have you experienced a feeling of depression on a gloomy, foggy day with its attending oppressive humidity? The day is dark, the air is close and you feel blue. Suddenly there is a whir overhead. The fog is collected into clouds. Then the sand is sprayed on them and before long it rains. The sun then comes out and you breathe a washed and cleansed air.

So far, experiments made by Bancroft and Warren have been highly successful, but thus far, of course, they are still experiments. However, they are planning other tests with heavier clouds for the next few months.

Mr. Warren has a theory that precipitation will be carried from cloud to cloud by a "trigger action," wherein electricity generated by the falling sand and rain will cause more to generate in adjacent clouds and thus set off the entire heavens, much in the manner of a long fuse. Doctor Bancroft doubts this theory, but the next big experiments will be carried out over the Atlantic as a safety precaution.

at
of
a get
"Spray-
charged sand
charged and
also will re-
around the
The large
of air around
extent down
some carry
fall and go

The Science of Laughter

An Interview with WILL ROGERS

THROUGHOUT the United States, Will Rogers, of the Ziegfeld Follies, is known for his genial wit. People seem to laugh spontaneously when he appears on the stage or the screen.

But here Mr. Wheeler sees the famous cowboy comedian in an entirely new role. He sees him not through the mask of comedy but as a sincere student of the mechanics of his business—the science of laughter.

By Edgar C. Wheeler

WHY should people laugh? What makes us shake our bodies and emit strange noises when something strikes us funny? And what effect, if any, have these apparently unnecessary contortions on our bodily health, our mental well-being and our success?

I put these questions to Will Rogers—the gum-chewing, lariat-swinging Will of stage and screen, who probably has made more people laugh than any other man in America.

I found him sitting in his dressing room at "The Follies," surrounded by the picturesque paraphernalia of his profession—typical cowboy outfits hanging on the wall, a dozen neatly piled coils of rope of various

"Why should people laugh?" he repeated. That's an easy one. People need to laugh to keep their minds and their bodies in good running order. It's a relaxation. It gives people a fresh start, with the slate wiped clean of past aches and worries, that is to say the physical and mental atmosphere is cleaned up.

Everybody should laugh. But what I'd like to know is why some people don't laugh. Do you know there are hundreds and thousands of people in the world who never crack a smile? What I'd like to find out is how to make them laugh."

And right there I discovered that this boyish cowboy funmaker is an honest-to-goodness scientist, although he denies it—emphatically. He is a scientist in that he systematically studies the faces in his audiences to find out why they laugh and how to make them laugh.

And the most remarkable thing is that his conclusions corroborate in a valuable and practical way the most recent scientific theories.

The Effects of Laughter

Scientists now tell us that laughter is just one way of giving vent to emotions that have long been repressed. It causes this relief from depression in two ways—physical and mental. Physically it stimulates circulation, increases depth and rapidity of breathing, and drives more blood to the brain. These things bring us a feeling of well being.

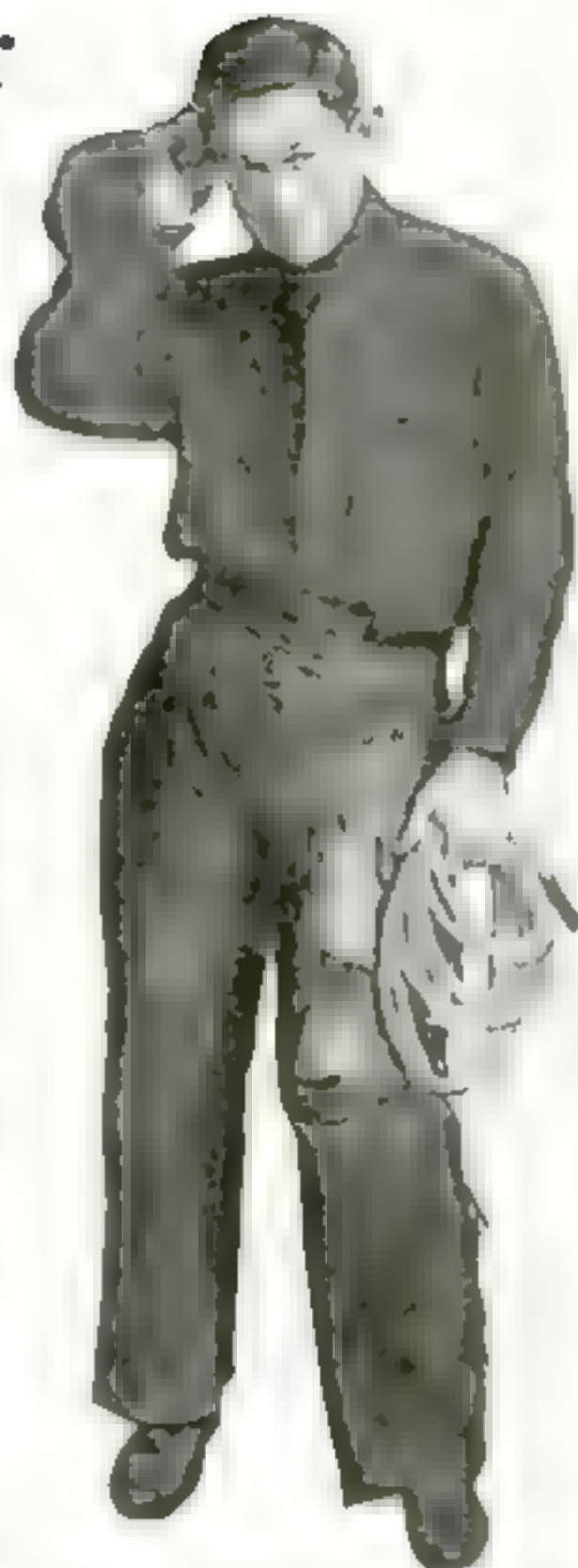
Psychologically laughter interrupts gloomy trains of thought and morbid pre-occupations. It uses up our reserve stores of energy, both muscular and nervous. It rebuilds worn cells in our systems. It relieves our nervous tension.

"Take that time in my career when I learned most about laughter," said Will. "It wasn't a Follies performance, it wasn't a banquet at the Waldorf, but it was when I went to Sing Sing Penitentiary."

"Usually I can tire out people in half an hour. But up at Sing Sing, when I spoke to the prisoners, I had to talk for a full hour and a half, and even then the men weren't satisfied."

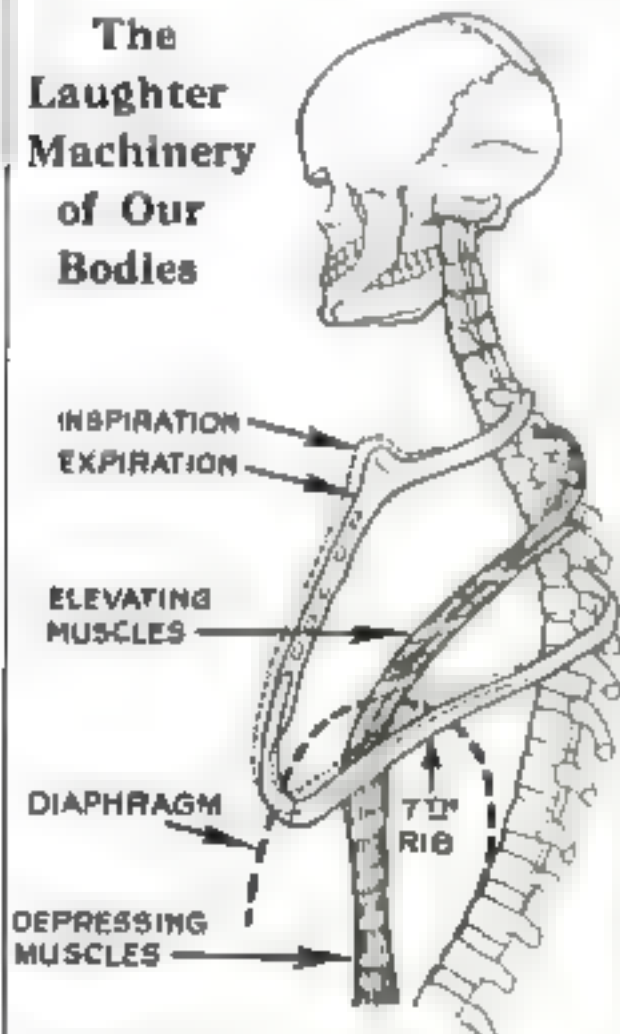
"Why was this? I think it was partly because a criminal is a thorough newspaper reader. He knows what's going on and he's quick to catch a point. But more than anything, he's ready to laugh. He needs to laugh. A loud guffaw is a relief from his oppressive surroundings."

In other words, according to the new scientific theories, when the Sing Sing convicts laughed heartily at Will Rogers' jokes, they were simply exhausting much of the excess nervous energy that previously they had spent in brooding. Afterward, they were less discontented, had less nervous



"Everybody should laugh. What I'd like to know is why some people don't laugh."—Will Rogers

The Laughter Machinery of Our Bodies



THIS diagram shows our bodily machinery of laughter. It consists chiefly of two sheets of muscles attached to the seventh rib—the longest and strongest of our ribs—and the large muscles called the diaphragm, as shown above.

lengths and thicknesses; a guitar standing in one corner. His jaws were working overtime, while his words dropped fluently between them.

Article published by arrangement with the McNaught Syndicate Inc.

energy to spend on gloomy thoughts.

The kind of things that makes us laugh—what we feel, or see, or hear—stimulate us to some sort of muscular activity, according to these theories. They do it by causing certain glands in our bodies to release substances into the system that stimulate us to action. We give vent to this need of action finally by bursting into laughter. The longer we are held in suspense, the more uncontrollable the discharge of emotion in laughter when the point of the joke releases us.

And now comes America's famous cowboy funmaker, whose one laboratory is the sea of faces, gay and sober, before him, to clinch all that science has found out about our bodily mechanism of laughter.

"What's your secret of making people laugh?" I asked him.

"Keep 'em guessing—that's the best bet. To get a joke over big, you've got to make your audience hold its breath in suspense while you lead them up to the point."

"The best humorist is the one who knows just when to suddenly open the safety valve of laughter. All of us have to experiment with a joke until we find the exact point where it goes biggest with the most people. I say 'most people,' because I don't know a single joke that will make everybody laugh."

Man—An Animal Invention

How Worms, Fish, and Reptiles Helped Create the Complex Machinery of the Human Body

The third of the series, "The Story of Man and His World"

By E. E. Free, Ph.D.

Fellow American Association for the Advancement of Science and

William K. Gregory, Ph.D.

Curator of Comparative Anatomy, American Museum of Natural History

ALIVING museum of the thousands of inventions devised by the striving creatures of past millions of years has been preserved for us inside the human body. It is a record of creation.

The bones are levers that move on self-oiling joints. The eye is a photographic camera, lens and all, and the sensitive plate inside it is so wonderful an invention that it renews itself continually and can photograph many images, one after the other, and accurately pass on each one of them to the brain. The digestive apparatus is an intricate and efficient power house equipped with a multitude of ingenious devices for getting the fuel value out of food. The heart is a self-regulating force pump. The voice is the most complete musical instrument ever devised.

All of these things and thousands of others like them were invented by our animal ancestors. Some of them originated with the tiny primeval speck of living slime that first learned to move itself about. Others came from the wormlike

creature that tried to crawl against the currents of water and invented the backbone. Still others are the inventions of the progressive reptile, millions of years later, who devised a way of keeping his body warm.

Everything that we are, the very fiber of our being, was made and tested for us by these animal inventors—lowly and forgotten geniuses who lived long ago and each of whom left his little contribution to the progress of life.

In the animal line of evolution the first great invention was that of motion. Primeval specks of slime, floating about in the sea water, learned to move themselves

tissues muscles. When we raise our arm it is not because something has pushed it up. The muscles on top of the arm contract and pull it up. When we want to lower the arm again, the muscles on its under side contract and pull it down. The motion is lever-like, similar to that of a steam-shovel. Movement of muscles, no matter what it seems to be, is always a contraction.

Muscles are really bundles of tiny fibers laid together side by side like the fibers of a rope. Each little fiber has the power of contracting at the command of its control nerve. The contraction of all of the fibers shortens the muscle and does our work for us.

The great original invention, therefore, the invention that made all the later ones possible, was the invention of the muscle fiber.

Another great invention was that of bone, of something hard and solid to support the soft framework of the animal and to which the muscle fibers could be attached. Based on the same idea is the steel skeleton of the modern skyscrapers. It was a very long time before this next step was taken. Many animals never took it at all.

Bones Our Patent

For instance, the mollusks, like the clams and oysters, have no bones, only a hard shell on the outside of their bodies. Internal bones are an exclusive possession of our own group of animals, of the backbone animals or vertebrates. They were invented by one of our particular ancestors and we have held a patent on them to this day.

The most important part of this bony scaffolding is the backbone. In the beginning it was scarcely a bone at all, only a rod of hardened tissue running lengthwise of the animal. It was invented scientists

COMPARE the two portraits below the one an intellectual type of modern man, the other an early caveman.

Notice the highly developed brain of the former and the low flat forehead of the latter. The man of today has developed a brain immeasurably superior to his low-browed ancestors. Yet fundamental similarities between the two are apparent. There is no scientific doubt as to their relationship.

THE relationship of the caveman to apelike animals his ancestors and ours alike is just as firmly established. And while modern man owes much of what he is to the man of the ice ages, he owes still more in the perfection of his body machinery to long-forgotten animals still farther down the scale of evolution.

This animal heritage of man is here explained by two eminent and brilliant writers. They tell how the human body was invented piecemeal millions of years ago. They say that it is Nature's own patent office—a living museum of innumerable inventions devised by our animal ancestors through countless prehistoric ages.

They did this by inventing a new kind of living matter, a kind that could contract and make itself shorter. This tissue could change the shape of the same speck or move its little tail about in the water and drag the speck along.

This power of tissue to contract is still the essential thing about all kinds of animal motion. In our body we call such



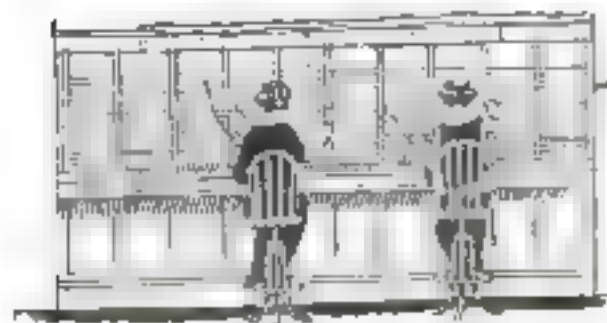
William Jennings Bryan, a typical intellectual modern man and a leading opponent of the theory of evolution.



A brute man of the ice ages, known as Neanderthal man. He lived in the caves of Europe some 50,000 years ago.

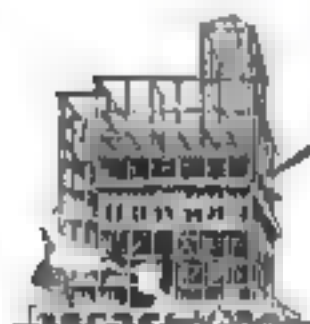
Your Body a Marvelous Machine

How Man's Inventions Are Equaled by Nature

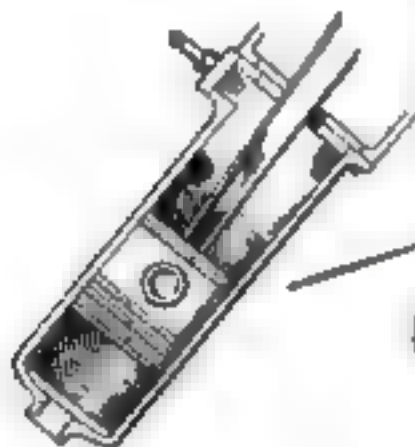


The brain is like a central telephone exchange

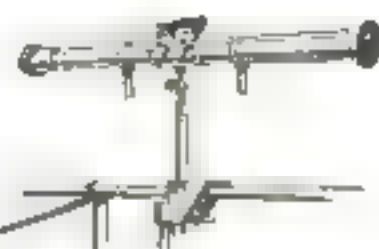
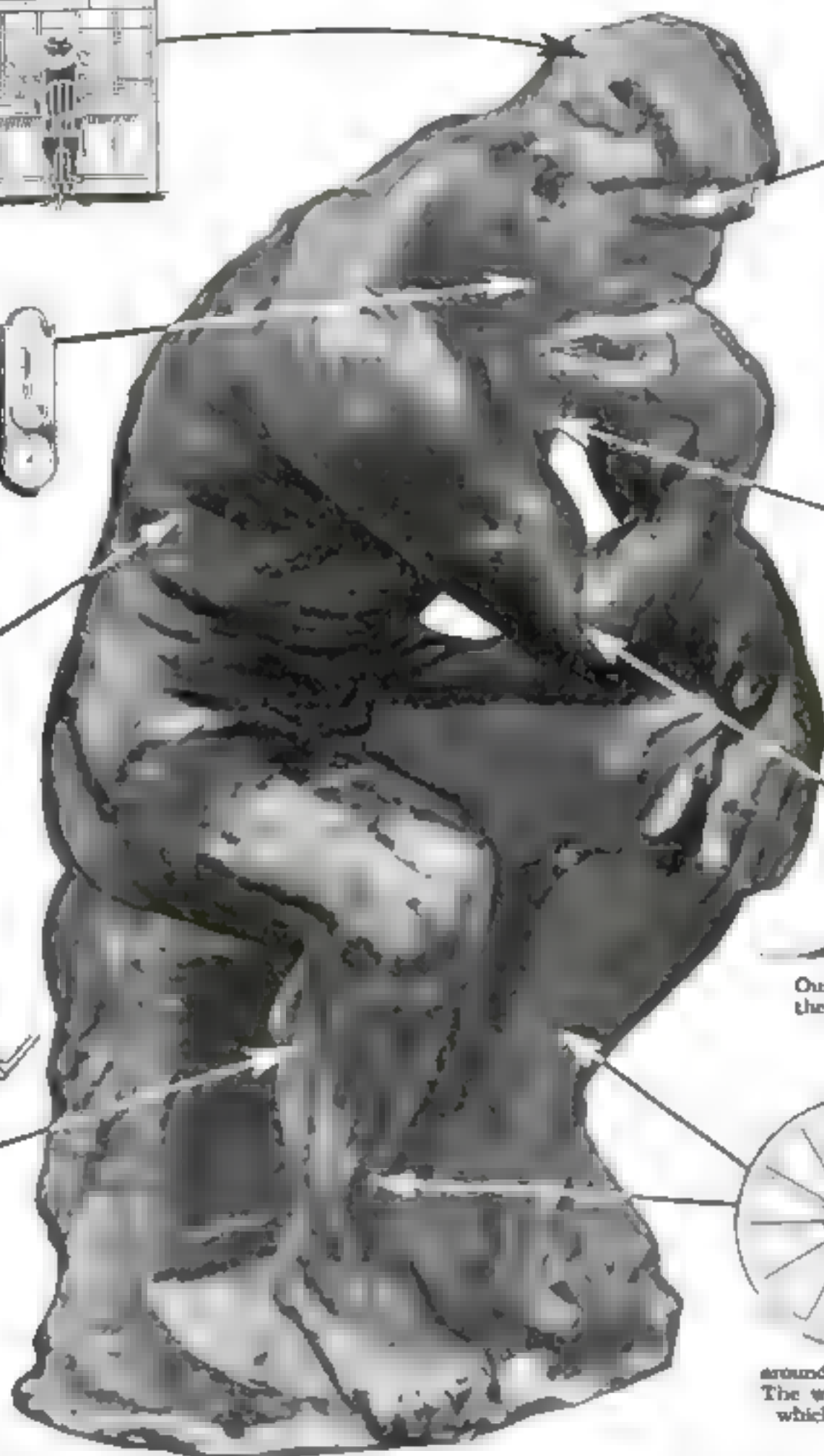
To maintain an even temperature in the body, Nature invented an intricate system of control, like a thermostat, operating through the glands and skin



The steel framework of the skyscraper was preceded millions of years by Nature's own invention of the skeleton



Our muscles, supplying the motive power for our bodies, are engines that work in a fashion comparable to this gas engine



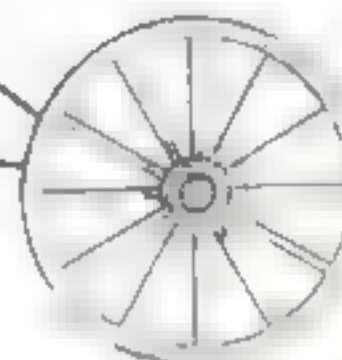
The double eye performing the same function as a military rangefinder, is an invention found only in man and a few animals. The eyes of most animals are so placed that they do not have range-finding vision



The most ingenious pumps ever perfected by man are far less marvelous than Nature's own invention, the heart, first devised by creatures in the sea countless ages ago



Our animal ancestors invented the arm with a lever motion like a steam shovel



The legs are nothing but two spokes of a wheel, moving back and forth instead of around, as they carry us forward. The wheel itself is one invention in which man has surpassed Nature

believe, along the seashore. Long before this, some little tubelike creatures, not very much longer than they were wide, had acquired the habit of clinging to the sea bottom by one end while the tide waved their bodies back and forth. Thus these creatures developed a difference between their two ends; one end clung to the bottom, while the other drifted freely in the water. This marked the invention of the head and tail.

The next step was that these creatures began to creep. Between the tides they would move slowly along the bottom, still holding fast by their head end, or perhaps fixing themselves anew after each little forward movement. Very slowly, generation after generation, they learned how to

move when the tide was running as well as when it was still. They became creeping wormlike things that could crawl against the tide if it were not too strong, as well as move with it as the other drifters did.

Then began the invention of the backbone. A stiffened rod down the back was a great assistance even in crawling against the current. It was absolutely essential if these creatures were to take the next step and swim upstream against the current, not merely crawl against it along the bottom.

And so they developed a rod of gristle down the back, the predecessor of the backbone. They became a very primitive kind of fish

Extensions of this great invention came

rapidly. Other bones were developed in the fish body; bones to support the sides as the backbone was bent, other bones to stiffen and move the fins, so that swimming would be easier. The development of our complicated skeleton was well under way.

The next great invention came when the fish went ashore. It was the invention of legs.

In the meantime, of course, there had been the invention of blood, which we shall speak of presently, and of lungs, which enabled the fish to breathe air. Even before legs were thought of, the fish had become an amphibian, like the modern newt or salamander, equally at home in the water or in the air.

The art of breathing air had been

developed already by two or three other kinds of creatures; by some shrimplike water scorpions that evolved finally into insects, and perhaps by worms like the modern earthworm and by shelled creatures like the snail. Life has discovered, from time to time, many ways of breathing air instead of water. The lung way, the invention of our particular fishlike ancestors, is only one of them.

This fish, as we say, had come ashore at least for part of the time. It could breathe water just as it had done always, or it could when necessary, breathe air. But on land its movements were very sluggish. It still squirmed along the ground a good deal as it had been accustomed to squirm along through the water. It was even more clumsy than a modern seal is on the shore. This was no sort of equipment obviously for the conquest of the land.

Fishlike Creature Invents Legs

And so this fishlike amphibian creature made the third of the great inventions. It learned how to lift itself off the ground. It invented legs, two pairs of jointed members between which the body was being dragged, which by moving back and forth could carry it along.

In the beginning its fins or flippers were used as oars in the water: they rubbed against the ground and helped to shove the prostrate body along. Gradually they got more strength; step by step they became able to lift the body off the ground. The fish became a reptile-like thing, running, somewhat sluggishly perhaps, on four legs.

Bones Found

In the ancient rocks of Texas geologists have found the bones of a creature just in this stage; half a creeper pushed along by its flipper-like legs, half a runner using these legs as modern reptiles do.

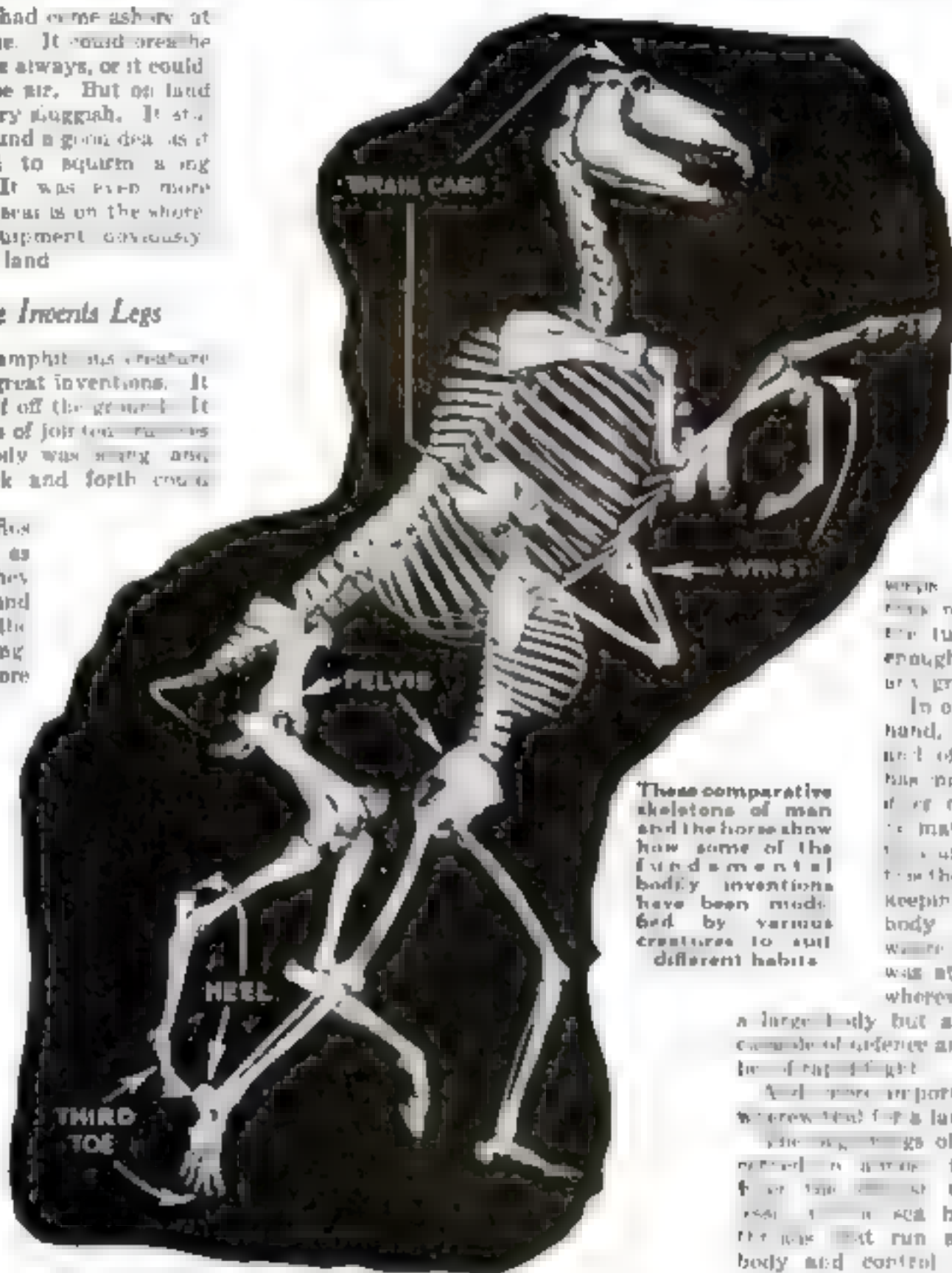
And now we come much closer to our own time. About a hundred million years ago the world was in the age of reptiles. There were many thousand kinds of them, from tiny lizards similar to our modern ones, to the great beasts such as the *Diplodocus* and the *Brontosaurus*, which weighed thirty or forty tons apiece. All these reptiles were cold-blooded, as are their survivors, the alligators, lizards and snakes of today.

Most of them were small-brained and un-inventive. That is why they died out. But one race of them did make an important invention, one of the most valuable that we enjoy. They invented warm blood.

This invention was much more important than it may seem at first sight. The energy of the body is chemical energy. It is produced by the burning of food. And like other engines run by fuel, the body works better and makes energy faster when it works at a higher temperature. It is like a steam engine using superheated steam.

The cold-blooded reptiles were handi-

capped by their low temperature. They could move rapidly only when the weather was warm. Every one knows how sluggish a snake is on a cold day. And so the reptiles that invented warm blood had a great advantage. They could move rapidly any time, in warm or cold weather. This was perhaps the greatest single step ever taken by life in escaping from slavery to climate.



These comparative skeletons of man and the horse show how some of the fundamental body inventions have been modified by various creatures to suit different habits.

Laurie American Museum of Natural History

There had been before this, of course, a necessary preliminary invention: the invention of blood. This we share with many other animals. It was made long ago in the sea. Probably it was originated and tested even before bones were developed. Certainly the fishes had it long before they came ashore. There had been invented, also, the devices of a force-pump heart and a system of elastic-walled arteries, by which the blood could be driven around through the body so as to supply oxygen and food materials to every little fiber of muscle and every little cell of nerve and brain.

This was necessary, let us remember, to any great increase of body size. In a great many of their characters some insects are more developed than human beings, they have gone farther along the path of evolution. But they have never become large. The largest of them, the great dragonflies of the coal age, were only about

two feet across their full spread of wing. The effective size of the insect family seems to be three or four inches at most.

This small size has been always a great handicap to the insects. It has made them an easy prey to larger creatures. It has prevented long life and the acquirement of individual experience. It makes large brains impossible. It has doomed these creatures, very wonderfully organized in their way, to be sinkers and fugitives, to occupy the chinks of the world that larger creatures do not try to fill.

The Secret

And this difference of size has been due mainly to different ways of breathing. The insects have no blood. They breathe by means of a number of tiny air-filled tubes running through their bodies and connecting with the outside air. Air

enters into these tubes and reaches the tissues. If the tubes are too long, not enough air will get in, and so very great size is impossible.

In our family, on the other hand, the invention of blood and of the force-pump heart has made it possible for us to draw oxygen to the tissues, no matter how deeply buried they are. When we added to this the device of warm blood, keeping all the tissues of the body at the temperature where their chemical activity was at its best, we had the wherewithal to build not only

a large body but an active one—a body capable of defence and of offence or, if need be, of flight.

And more important still, we had the wherewithal for a large and active brain.

The workings of the brain can be discovered in some of the earliest creatures that we know of that float about aimlessly in the sea. It has a ring of nervous matter that run around its bell-shaped body and control its movements. The earthworm has a nerve cord down its back and a little knot of nerve matter near its head; the promise of a brain.

But an actual brain, something capable of real thinking, was possible only when warm blood had been invented. The brains of the great cold-blooded reptiles were ridiculous little things no larger than the human fist, though the beasts themselves were 80 or 90 feet long.

Billions of Cells in Human Brain

Our brain, on the other hand, is a great group of many cells, nearly ten billion of them, closely packed together so that they can be in very intimate contact with each other. All these cells must be fed. They must be supplied with oxygen. If they are to do their best work, they must be kept at a constant temperature.

You see how important it was for us to have a forced circulation of warm blood well charged with oxygen. Without this

(Continued on page 105)

A Baby—An Open Safety Pin

How Doctor's Ingenuity Saved Child's Life

TWO looped wires. A tiny pair of pincers at the end of a third wire sheathed in a hollow tube. A tiny electric light bulb.

With these as his only tools, Dr. J. H. Buff, young throat specialist of Atlanta, Ga., recently succeeded in fishing an open safety pin from a baby's stomach without using knife or anesthetic.

This thrilling victory of science and ingenuity was won after other physicians had given up hope.

Missing—One Safety Pin

Early one morning, the mother of six-months-old Mac Asbill, Jr., had given the baby his bottle of milk and had put him back to bed, pinning the covers about him. A few minutes later, she heard the baby scream and picked him up. She noticed that one of the safety pins was gone.

After a vain search for the pin, she called a doctor. An X-ray revealed that the child had swallowed the safety pin, that the pin was open, and was lodged in the stomach with the sharp point and the safety catch upward near the throat entrance.

Doctor Buff was called in. After examining the X-ray pictures, he declared that he would extract the pin, and soon had prepared his ingenious instruments.

To the handle of a tiny pair of pincers he attached a wire 1½ feet long. At the end of two other wires of the same length he prepared small loops. One of these loops was to slip over the butt of the open pin, so that when the wire should be pulled upward, it would close the pin. The other loop was to slip over the pincer handles to tighten the grasp of the jaws as soon as they should catch the head of the pin. At the end of a fourth wire he attached an electroscope—a tiny electric light. Two handles like those of scissors were attached to the free ends of the wires controlling the pincers.

How the Job Was Done

The child's head and arms were held. Doctor Buff fixed around his own head one end of the wire suspending the electroscope, then lowered the light into the baby's throat. In his right hand he held the handles of the two pincer wires and after slipping the loop over the pincer jaws, carefully inserted the tool and wires into the baby's throat to the point where the throat enters the stomach. In his left hand he held the second looped wire, which he also inserted.

With his left hand, Doctor Buff slipped this wire loop over the butt end of the safety pin, and by pulling the loop upward, forced the point of the pin toward the catch. Then, with the pincers manipulated by the wires in his right hand, he caught hold of the head of the pin, tightening the grasp of the pincer jaws by pulling the loop up over

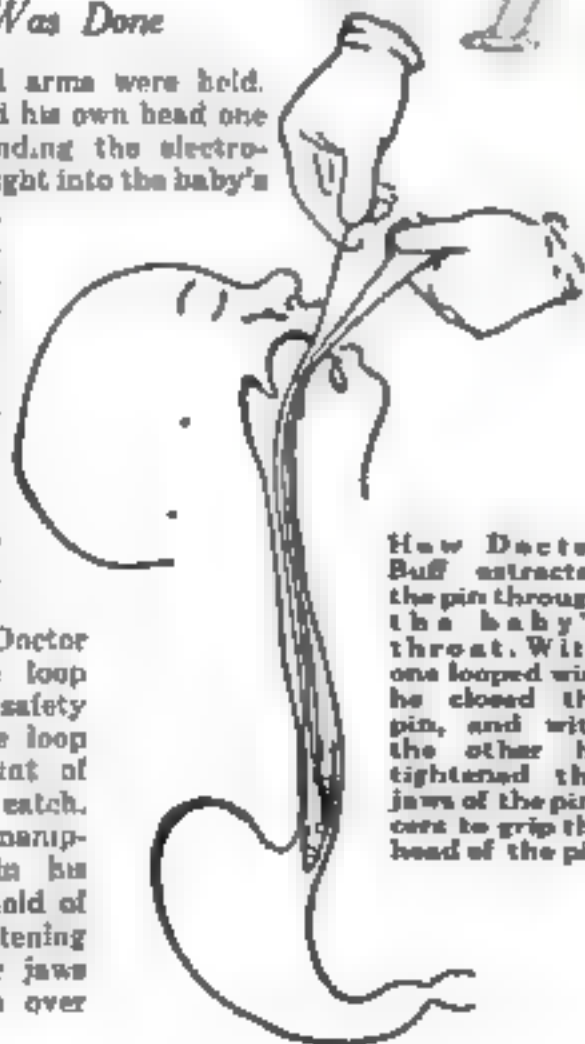


Baby Mac Asbill, who swallowed the open safety pin and survived

the handles. A few careful manipulations and the pin point was safe in its catch, and the closed safety pin was withdrawn from the child's stomach. The young throat specialist's ingenuity, skill, and nerve had saved the baby's life.

It was an operation that required the utmost speed and precision to prevent the baby from choking. At one point in the manipulations, when the child's breathing became difficult, the apparatus had to be withdrawn temporarily.

Dr. J. H. Buff, who saved the baby's life, and the hastily improvised apparatus of looped wires and pincers with which he closed the safety pin and drew it from the child's stomach



How Doctor Buff extracted the pin through the baby's throat. With one looped wire he closed the pin, and with the other he tightened the jaws of the pincers to grip the head of the pin



This X-ray photograph revealed the position of the open safety pin close to Baby Mac's stomach, with point pricking upward. It was this photograph that guided Doctor Buff in the delicate manipulations by which he closed the pin and grasped it with pincers

Artists' Thumbprints to Identify Paintings

LIKE the climax of a fantastic detective story is the latest achievement of science in comparing fingerprints to identify as a real Da Vinci an age-worn canvas, recently bought by a New York collector of art.

The question whether a certain painting is the original work of a great master can now be determined absolutely, simply by examining the painting for fingerprints left on the canvas by the artist and comparing these with fingerprints found on paintings known to be authentic. Signatures can and have been duplicated. Fingerprints cannot be forged.

When George T. Pearsons of New York last year acquired two rare old paintings, the restoration of one of them, believed at first comparatively little worth, revealed a picture that at once identified it as the work of a master.

"From what I could judge," said a restorer, "the painting was a Giampetroni. But the restorer, who had worked on many famous old paintings, expressed his opinion with confidence the belief that it might be the work of Leonardo Da Vinci, one of the old masters.

Finally, one day there came to my office Arthur S. Sowaal, a fingerprint expert and artist. When he was talking to me, his attention suddenly became focused on the painting hanging in my office.

"Examining the canvas through a magnifying glass, he discovered that in the pigment of the painting appeared several fingerprints of an unusual nature. All of them were of the plain arch type—a fingerprint type characteristic of only five per cent of all persons who have recorded the swirling lines of their fingertips. And on all of them appeared two well defined scars.

"Then began a series of remarkable demonstrations of the accuracy of fingerprint records, which finally confirmed my painting as a real Da Vinci.

"Sowaal's first move was to photograph with his fingerprint camera all of the fingerprints he found on my canvas. These he deposited with me. Then he went to the New York Public Library and examined a score of enlarged photographic reproductions of the works of old masters. Finally, he obtained permission to photograph certain finger-marked sections of reproductions of Da Vinci paintings.



Arthur Sowaal, fingerprint expert photographing Da Vinci's thumbprints that proved the painting of Saint John to be a 400-year-old masterpiece, worth its weight in gold.

"The fingerprints were calibrated with delicate instruments and compared with such care, that they proved the same hand executed all of them.

"For final, clinching evidence, the fingerprints on my painting were compared with those found on Da Vinci's 'Virgin of the Rocks' in the National Gallery, London.

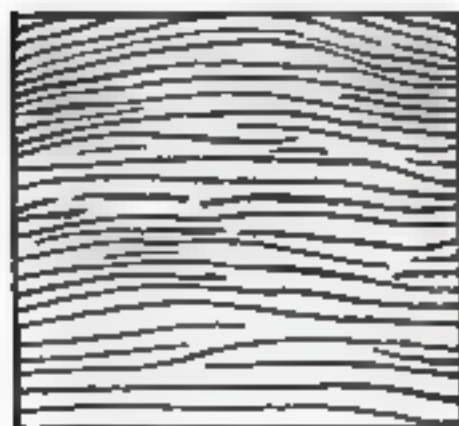
"Da Vinci, who was a sculptor as well as painter, used his left hand in painting and often obtained the desired result on his canvas by impressing his finger on the moist pigment. Often, his paintings show, he made a long, sweeping movement with

his right thumb to produce a shadow."

"The scar on the Da Vinci fingerprint is an elongated figure eight or double circle. The proof is molded in the paint and as long as the pictures exist, just so long will the evidence remain," says Sowaal.

There is other evidence, further substantiating Sowaal's findings. In 1510, Morelli, a contemporary of Da Vinci, pointed out to a group of friends that Da Vinci used his finger in painting. Further, it is recorded that when Da Vinci was urged to sign his masterpieces he proudly replied "My marks are all over my work."

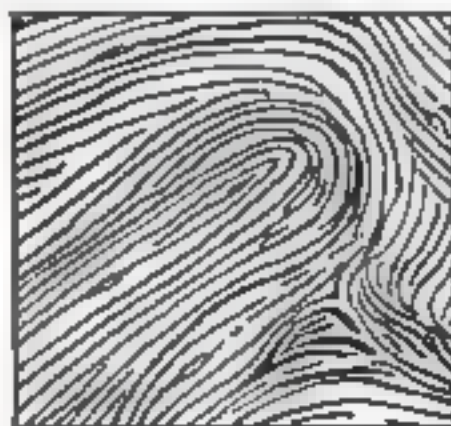
Which of These Types of Fingerprints Is Most Like Yours?



Da Vinci's fingerprint is of this rare arch type



Accidental type—another exceptional formation



The loop type includes 30 per cent of all fingerprints



Common whorl type 60 per cent of all fingerprints

Miniature Moving Airplane Trains Army Gunners

TO TRAIN anti-aircraft gunners in sighting a moving airplane, an American army officer has designed an indoor moving target that duplicates actual war-time conditions.

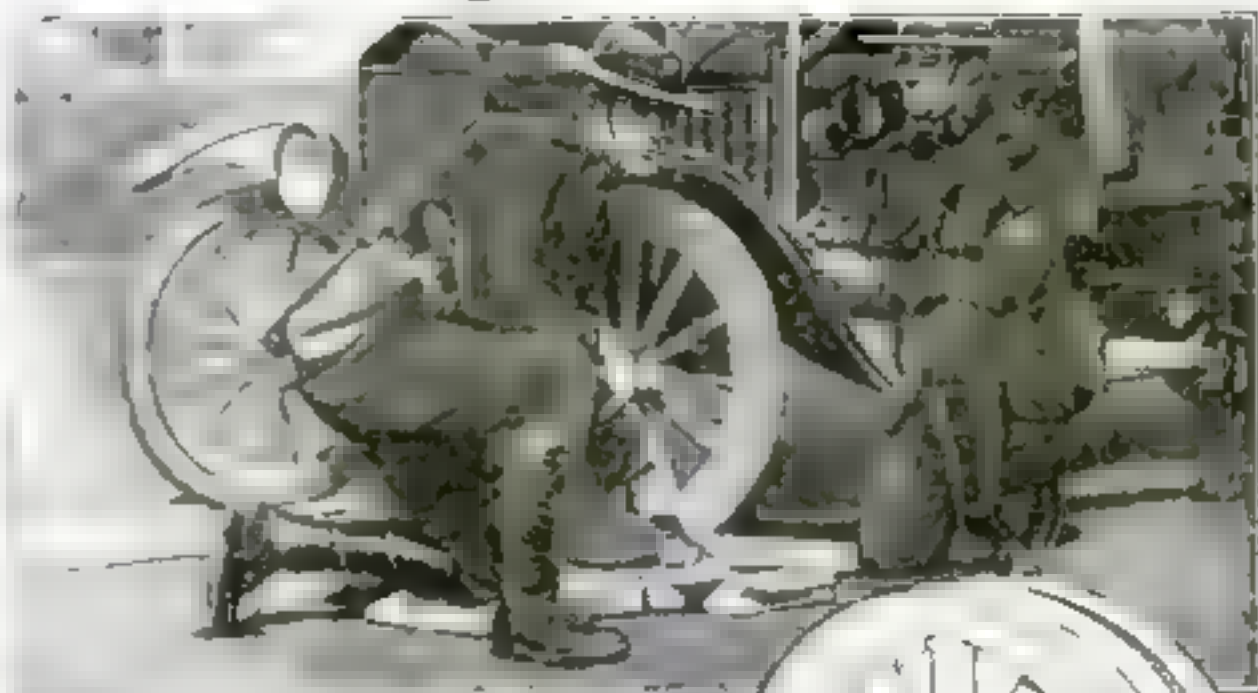
From the top of a 30-foot pole, mounted on an electrically driven truck, are suspended a series of wires along which a miniature airplane can be made to move up and down by the truck operator.

The truck is driven around the floor of an armory, while the plane is raised and lowered. Meanwhile, the gunners at their sights follow the searchlight-illuminated target, just as they would if operating against actual planes in wartime.



The operator raises and lowers a miniature airplane while the truck moves.

Autos Weighed without Jacks



First the front wheels, then the rear wheels are rolled on these flat scales and the weights read on a dial.

PORTABLE scales that weigh motor trucks without using jacks are aiding in the enforcement of motor vehicle laws designed to protect roads from overload. With two of these scales, developed by H. C. Berry of the University of Pennsylvania, officers can determine the exact weight of a truck in a few moments.

After setting a scale in each wheel track, the front wheels of the truck are driven onto the scale platform, stopped, and the weight read. The rear wheels then are weighed in the same manner. The sum of the four readings is the weight of the truck.

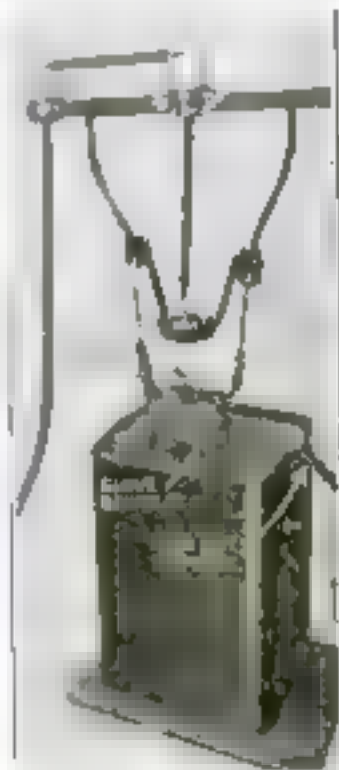
The capacity of the scale is 15,000 pounds. The scale itself weighs only 80 pounds. With the approach blocks and steel plate used under the scale to permit the quick adjustment to different wheel treads, the scale may be packed in a case 18 by seven by 30 inches. Two cases may be carried easily in the tonneau of a small car, making it easy for officers to transport the scales from place to place.



Linemen's Gloves Tested under 10,000 Volts

TO ELIMINATE the danger resulting from slight leakages in rubber insulating gloves worn by linemen, a public utility concern of Baltimore tests all gloves under high tension once a week.

In the company's laboratory the gloves are first inspected inside and out for defects. Then they are filled nearly full of a salt solution, and are immersed in a similar solution to a corresponding depth. The inner solution is then connected with one terminal of a high voltage system, while the other terminal is grounded. The voltage is gradually brought up to 10,000 volts in the case of new gloves, and 9,000



This apparatus detects any leakage.

in the case of used gloves, remaining on for a minute.

Any current that passes through the glove into the outer solution indicates a leakage.

THE Editor will be glad to supply, wherever possible, the names and addresses of manufacturers of devices mentioned in this issue of POPULAR SCIENCE MONTHLY.

Ironingboard and Table in Wall

A RECENT development along the line of economizing space in the kitchen is a combination ironing-board and table that disappears into a built-in cabinet between studding. The cabinet occupies a space in the wall 14 inches wide, 82 inches high, and 8½ inches deep.

When lowered into position, with leaves unfolded, the table measures 22 by 36 inches. The ironing-board may be swung down on the folded table leaves for support.

The lower panel of the cabinet swings outward to form the support for the table. A small compartment in the top of the cabinet may be used for storing small utensils.



At left: The table swung down, with leaves unfolded. At right: The ironingboard rests on the folded leaves.

Are You Too Fat?

Better Be Underweight than Over, Says Famous Medical Scientist, Who Tells How to Exercise and Diet to Grow Thin

Chances for Long Life 3 to 1 against Stout Man Declares Dr. Eugene Lyman Fisk

HAVE you stood recently on a public scale, scanning the printed table telling you how much you should weigh at a certain age and certain height?

And have you felt a glow of satisfaction when the indicator swung round to a figure corresponding to, or just a bit beyond, the "average weight," supposed to be the "correct weight" for you?

The Average Person Is Overweight

If so, your satisfaction was premature. The average person is overweight—and that means he is far more subject to disease, especially after 40, than is the individual who is actually under the average figure.

So says Dr. Eugene Lyman Fisk, medical director of the Life Extension Institute, in an exclusive interview for POPULAR SCIENCE MONTHLY.

"Medical science has long known the bad effects of overweight," says Doctor Fisk. "But only recently have we discovered by an analysis of insurance and army records that the 'average' person does not stand the best chance of living long. In fact, the man or woman who weighs 20 or 30 per cent below the average has the best chance for long life at most of the ages after early adult life.

'Up to the age of 30 it does little harm to be overweight, as long as that weight does not reach serious proportions; but after 30 there is an increasing danger in overweight, and an increasing advantage in being slightly underweight. It is safe to say that the average individual reaches the ideal build at 30. If he can keep near that build for the rest of his life, he increases his chances of longevity. After 40, life insurance records show, the danger in overweight increases alarmingly, especially if the excess weight consists of fat, as in cases of excessive girth.

Watch Your Waistline!

"In general, chest measurement should equal at least half the height, and the girth of the waistline should never exceed the chest measurement. The average individual's overweight, although it may reflect some slight influence of glands, is largely the result of too much food and not enough exercise. Excess food is accumulated as fatty tissue, usually around the waist.

"The average man or woman at rest requires between 1600 and 1700 food calories of heat. Moderate activity adds from 500 to 1000 calories to this requirement. Therefore, if the body is getting more than this

amount, the result is too much fat. Every person should know something about the calory values of food. Ordinary portions of food contain about 100 calories—for example, one egg, a small glass of milk, or a moderate helping of roast beef.

"Yet a chocolate ice cream soda contains the same number of calories as a meal of fish cakes, bread and butter, and macaroni. Lean meat and non-fatty fish are not highly fat forming. An appetizing diet that is not fat forming may be based on these articles of food.

"Eggs, meat, fish, fowl, soups, green vegetables of all kinds, most fruits, potatoes in moderate amounts, butter, milk, tea, and coffee.

"Cereals, bread, and cake should be taken only in limited



William C. McAdoo, former Secretary of the Treasury, who typifies the average American business man's physique.



What chance has the fat man, compared with the slim man, in the race of life? These illustrations, based on "idealized" life expectation records of life insurance companies, show that slim men can hope to live longer. The men above are 30 pounds under average weight, those on page 41, 30 pounds overweight. Starting at the age of 30,

Here's the Ideal Weight for You

(Weight at age 30 for various heights)

MEN

5 ft.	
5 ft. 1 in.	
5 ft. 2 in.	
5 ft. 3 in.	
5 ft. 4 in.	
5 ft. 5 in.	
5 ft. 6 in.	
5 ft. 7 in.	
5 ft. 8 in.	
5 ft. 9 in.	
5 ft. 10 in.	
5 ft. 11 in.	
6 ft.	
6 ft. 1 in.	
6 ft. 2 in.	
6 ft. 3 in.	
6 ft. 4 in.	

WEIGHT

128 lbs.
130 lbs.
133 lbs.
136 lbs.
140 lbs.
144 lbs.
148 lbs.
152 lbs.
156 lbs.
161 lbs.
166 lbs.
172 lbs.
178 lbs.
184 lbs.
190 lbs.
196 lbs.

WOMEN

4 ft. 8 in.
4 ft. 9 in.
4 ft. 10 in.
4 ft. 11 in.
5 ft.
5 ft. 1 in.
5 ft. 2 in.
5 ft. 3 in.
5 ft. 4 in.
5 ft. 5 in.
5 ft. 6 in.
5 ft. 7 in.
5 ft. 8 in.
5 ft. 9 in.
5 ft. 10 in.
5 ft. 11 in.
6 ft.

112 lbs.
114 lbs.
116 lbs.
118 lbs.
120 lbs.
122 lbs.
124 lbs.
127 lbs.
131 lbs.
134 lbs.
138 lbs.
142 lbs.
146 lbs.
150 lbs.
154 lbs.
157 lbs.
161 lbs.

amounts by those who wish to reduce weight. Butter, fatty portions of meat, salad oil, cream, and nuts, contain large amounts of fat. Starchy foods, especially breadstuffs and pastry, are fat producers, while sugars and sweets of all kinds are pure fuel.

"What happens, of course, when we begin to get overweight is that each added pound makes us less likely to exercise and each decrease in exercise results in more fat. The reason of the influence of overweight on mortality tables is that an excess burden is laid upon the liver, heart, and kidneys; there is faulty elimination and a tendency toward fatty degeneration of the organs. Lack of exercise brings in its train muscular degeneration, faulty cell activity, and toxic conditions. High blood pressure is common among overweights.

"There are two good methods of cutting down weight—by exercising and by diet. Neither is perfect alone.

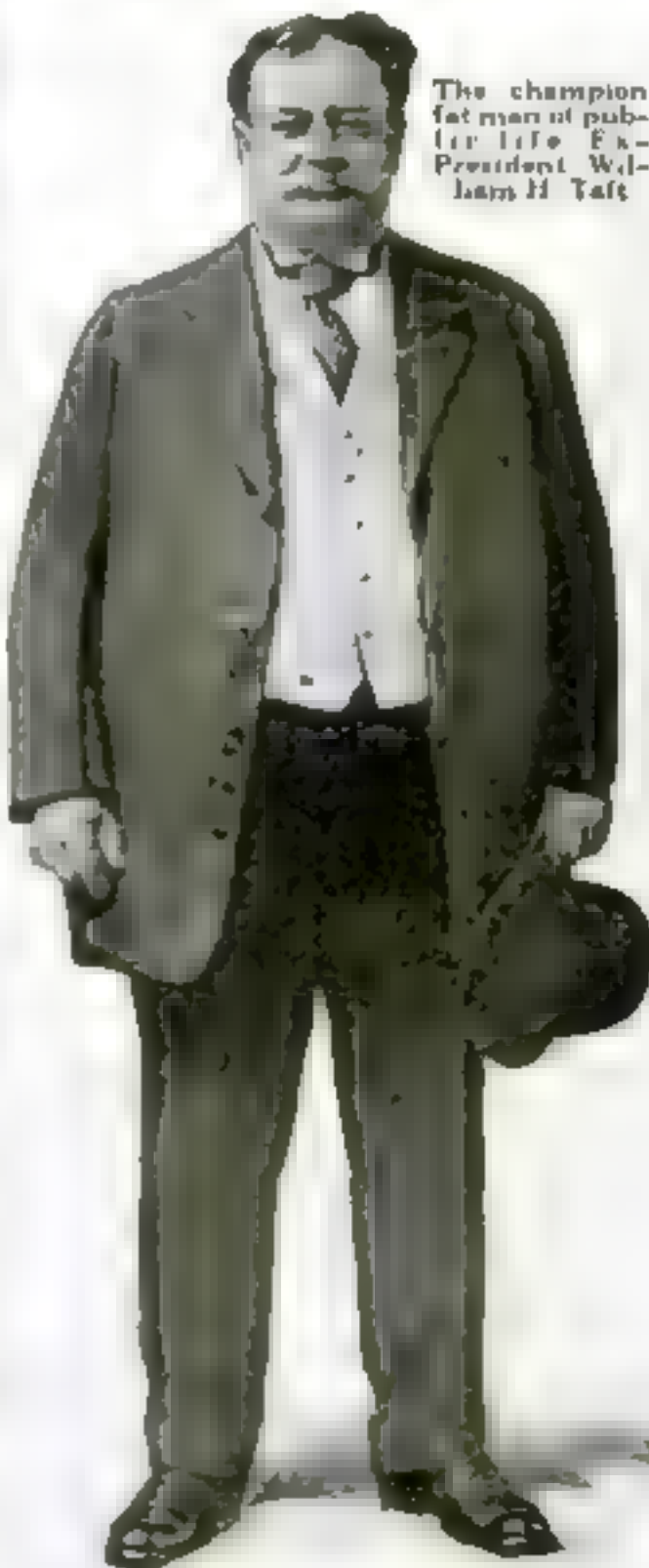
"The average system for weight reduction by exercise is illogical. More reliance must be placed on diet than on exercise. Remember that eight hours of steady walking serves to burn up only four ounces of fat, while the results from cutting down even a small part of the fat-forming food is almost immediate. In other words, it is best to cut down the weight gradually by increasingly strenuous diet and to increase exercise by slow degrees. It is positively dangerous for the very fat person, especially at middle life, to plunge into heavy exercise.

"One reason why overweights have difficulty in reducing is that as the weight decreases there is often a feeling of goneness that drives them to eat too much. The remedy is a harmless between-meal indulgence such as a cup of beef bouillon.

"Very often, physically lazy people who rely on diet alone to

decrease weight, suffer from a flabbiness of the muscular tissues and this, of course, is harmful. Nitrogen material lacking in non-fat-forming foods and necessary for the muscular tissue must be supplied by proteins from eggs, milk, meat, or flesh food free from fatty oils.

"Weight reduction is an extremely important matter, as the statistics of life insurance companies show. And, in general, you may be sure that in watching your waistline, you watch your health."



The champion fat man of public life. Ex-President William H. Taft



each group contains 10 men. At 40, each group has lost one. At 50, three more fat men have dropped out, while the slim men hold their own. At 60, half the underweights are left; the overweights are reduced to three. Crossing the line at 70, three of the original 10 slim men are left, while only one lone fat man out of 10 reaches the tape.

Hooligan Fish Burn as Candles

HAVE you ever used a fish for a candle?

Probably not, unless you have spent some time in the Far North or on the northern Pacific Coast. But the Alaskan "sour dough" will tell you that the finest food fish in the world may be lighted and burned—tail up—just like a candle.

One of the most picturesque industries in Alaska is the harvesting of this unusual smeltlike fish, called variously "hooligan," "oolican," "holican," and "candle," but correctly termed "eulachon," which is Siwash Indian for candle.

Now, picture to yourself a clear, glacial stream winding through hills topped by rugged white mountains. On the mossy river banks at every bend of the stream rise plumes of smoke, marking Siwash encampments.

Each camp is a scene of intense activity. In dugout log canoes at the water's edge Indians wield scoop nets, hauling up the silver horde of "hooligan" fish from the choked river. Farther up the river bank boys tend huge log fires that have been built upon rock piles. Close to the fires are deep trenchlike pits to which squaws and children carry baskets of fish.

Rendering Out the Oil

When the first pits are filled, the work of rendering out the oil—a task that falls to the old men—begins. Across the waist of a canoe that has been thoroughly cleaned, a cradle of sticks is laid, and on the cradle are placed heated rocks from the fire. The fat fish, placed on the hot rocks, give up their oil, which drips down into the canoe.

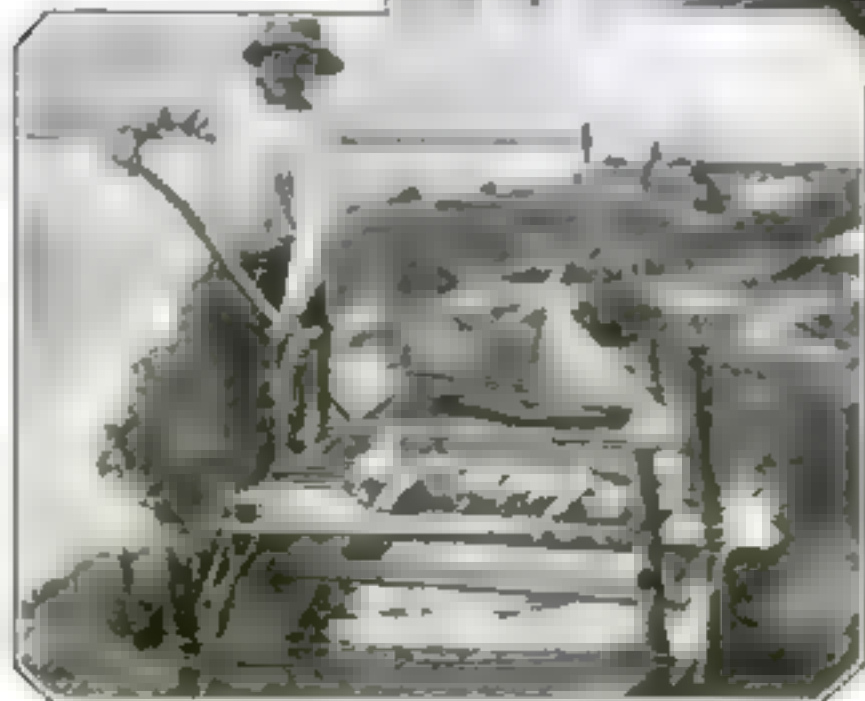
When a canoe has been filled, the "hooligan" oil is allowed to cool, and takes on the consistency of lard. This is then stored in skins, crocks, or other utensils, where it keeps indefinitely.

The "hooligan" is a relative of the smelt and a distant cousin of the salmon. Like the salmon, it goes up the river to spawn, dying when it has reproduced itself.

Many Alaska miners have used the dried fish for candles, and the Indians prize it for cooking. When flavored with wild berries, it makes a delectable dish.



How the "hooligan" fish is turned into a candle. The dried fish is impaled on a stick and the tail is lighted.



At left: Rendering the oil. Across the canoe is laid a cradle of sticks supporting heated rocks. As the fish sizzle on the rocks, the oil drips down into the canoe.

Apartment House Soprano Wears Muffler Muzzle

ANY aspirant for grand opera who must practice scales will retain the love of neighbors by wearing a light song-silencer that will not spoil the volume or tone.

The singer is the only person who hears a sound. From the mouthpiece a tube leads into a muffling drum, from which two tubes return to the ears of the soloist.

The interior of the drum consists of a series of baffle plates that break up the sound waves, somewhat on the principle of a Maxim silencer.



This muffling drum drowns the voice.

Artificial Light Tests Ink

VIOLET carbon arc lights, long used to test the resistance of clothing to the fading action of the sunlight, are now being used to determine how long the ink used on billboard posters will withstand the action of the sun. A poster is expected to withstand the weather for 30 days.

In 42 hours a new testing device gives the equivalent of a month's exposure to mid-summer sun. The arc is in the center of the cylindrical container, and 40 samples of lithographic ink are placed in the little windows around the circumference. Half the sample is exposed, and the other half protected from the light by a metal shade. Special carbon rods impregnated with a secret chemical formula give the light of this arc fading qualities exactly similar to sunlight, although greatly intensified.



Testing samples of ink by arc light.

Martyrs of the Speedway

"ANOTHER racing driver killed!" Behind that newspaper headline is hidden the true story of automobile development—a story to be told for the first time in the JUNE POPULAR SCIENCE MONTHLY.

It is a story of mangled bodies of racing drivers—mileposts on the road to automobile perfection. It tells of that progress that demands sacrifice.

Place your order for the June number with your newsdealer today.

Is Water Cooling for Autos Out of Date?

By Harold F. Blanchard

THE air cooled automobile engine is coming into its own.

Today it is safe to predict that a large percentage of cars of the future will be air cooled rather than water cooled—a prediction that is well borne out by the success of the newest air cooled car on the market, put out by one of America's foremost automobile manufacturers.

Compared with the water cooled engine offered with the same chassis by the manufacturers, the new engine has proved that it runs faster and develops more power. And the capacity of the cooling system for dissipating heat is fully as great.

Advantages of Air Cooling

Another important factor in predicting the future is that the air cooled machine is winning its way into popular favor. It is simpler, lighter, more economical than its water cooled brother, and it is free from cooling troubles. It can't be overheated in summer nor frozen in winter.

This trend toward air cooling is largely due to the success of one persistent manufacturer of a well known air cooled car, who has proved, year by year, that air cooling need not necessarily mean freakishness. Repeated public tests have demonstrated that his air cooling system would stand abuse to an extent that would spell ruin to any water cooled engine. A hundred miles at full speed in low gear has become a somewhat commonplace demonstration for the car.

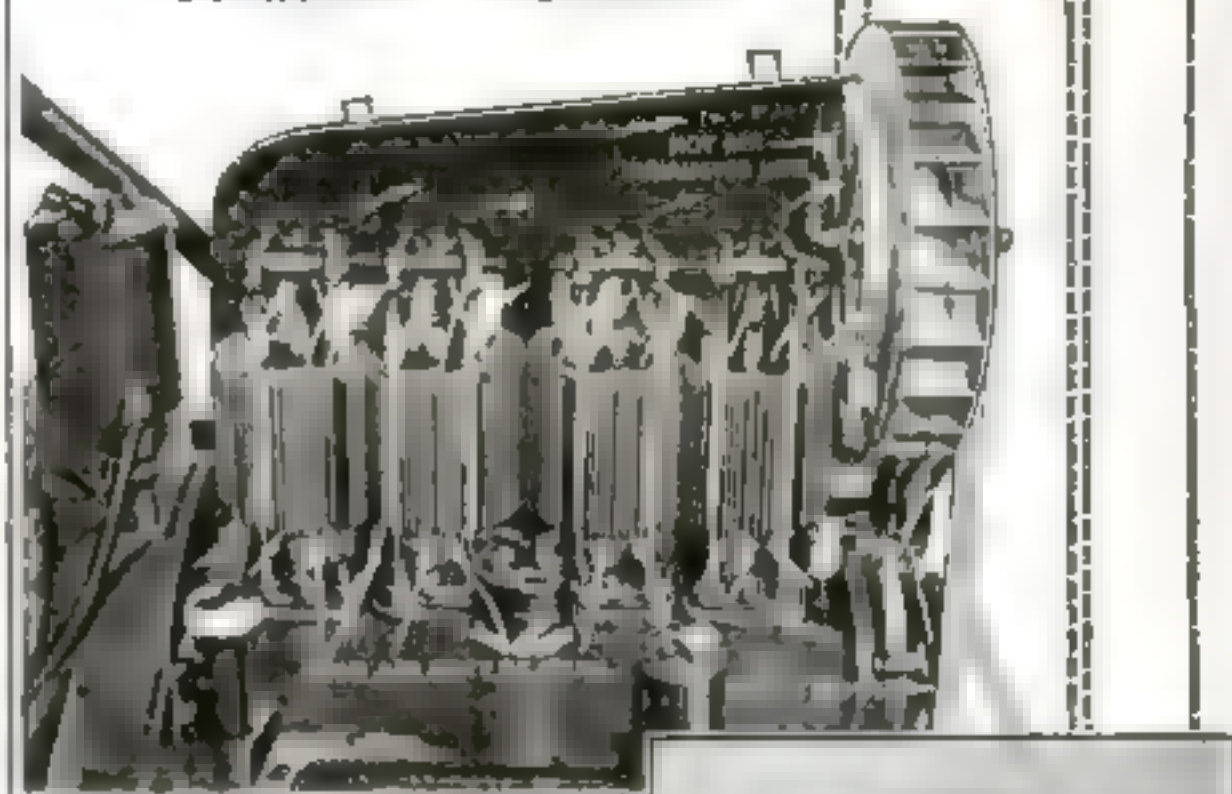
Not long ago another successful air cooled car was introduced—a high grade, six-cylinder machine with low, smart lines and the equal, in appearance and performance, of any water cooled machine.

Air-Jacketed Fins Cool Cylinders

The engine is of ultra-modern design, with overhead valves, overhead camshaft, and a seven-bearing pressure lubricated crankshaft. The cylinders are equipped with vertical, air-jacketed fins, the air being supplied by a blower on the front end of the crankshaft and passing through a duct that incloses the overhead valve mechanism.

And now, the manufacturers of one of America's most popular medium priced cars that always in the past has been water cooled, have gone one step beyond the makers of air-cooled cars, using copper cooling fins in place of cast iron fins integral with the cylinder walls. Since copper has twice the conductivity of cast iron, heat will flow through the copper fins many times as readily as it will through cast iron fins. In the new car the copper fins are welded to the cast iron cylinders and this in itself is a real engineering triumph. Welding of this sort is essential for successful use of copper fins, for if the fins were merely forced into slots in the exterior of the cylinder walls, the cooling effect would be largely lost, because heat flows through a joint about as

Newest Air Cooled Car Has Plenty of Power without Radiator Troubles

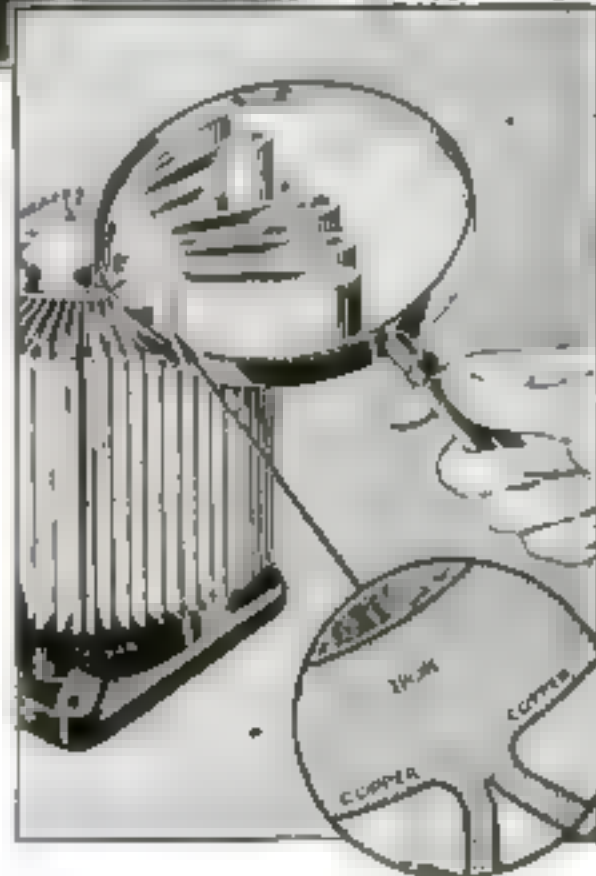


Above: Improved air cooling system as applied to one of America's most popular cars, showing how blower fan at the front of the engine sucks and air through looped copper cooling fins welded to cast iron cylinder walls, as pictured at right.

reluctantly as an electric current jumps a gap.

Still another clever feature of the new engine is the "looping" of each fin so that a hollow "boat shaped" passage runs down through its center. A counter-fan at the front of the engine sucks up the air through these fins into a duct that covers the cylinder heads. Since the fins are hollow and the air passes through them, no air jackets are required.

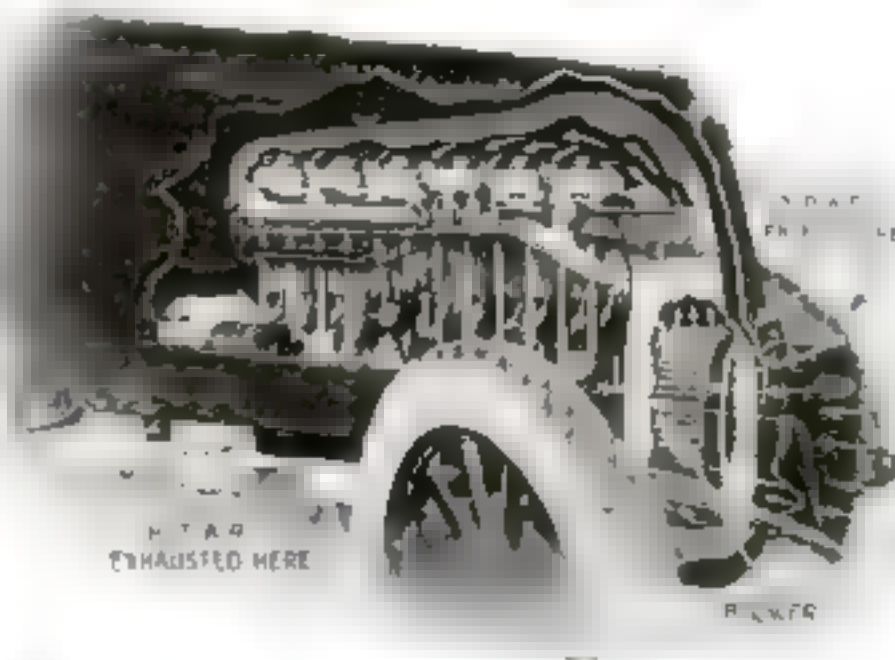
Fundamentally every automobile engine in the world is air cooled. In the water cooled car the water is merely the agent that takes the heat away from the cylinders in a hurry and disposes of it the old way of the radiator, which has a surface



many times the area of the cylinder walls. It is the air flowing through the radiator that finally receives the heat that seeps through the cylinder walls.

In the newest air cooled car, the copper cooling fins draw the heat from the cylinder walls just as quickly as does water, and the rush of air through the hollow fins is sufficient to carry the heat away as fast as it is withdrawn from the cylinder walls.

That, in a nutshell, is the reason why the improved air cooled engine is the equal of the water cooled design in every respect, and why we may safely predict that air cooled cars will be the popular cars of the future, largely replacing the water cooled car.



Latest model of the one air cooled car that has enjoyed success for years. Observe that the direction of cold air flow is the reverse of that in the newest air cooling system shown at the top of the page—that is, the cold air is sucked in at the front.

Bright Lights Cost New York \$70,000,000 a Year



© Wirephoto Photos

IT COSTS New York more than \$70,000,000 yearly to present this spectacular display. More than 2,000,000 tons of coal costing \$16,000,000, are required to produce the 1 1/2 billion kilowatt hours of electricity consumed by the city in a year. The

street lighting alone involves an expenditure on the part of the municipality of over \$3,000,000. For 12,000,000 filament lamps are required to supply the necessary illumination for the crowded thoroughfares of the great metropolis.

Automatic Quartermaster Steers Ship

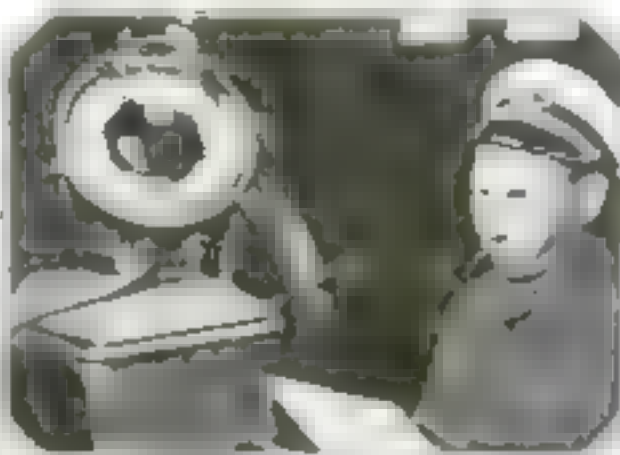
ADD to the long list of modern mechanical marvels the self-steering ship, guided by an automatic quartermaster.

This remarkable maritime development is made possible by the invention of the steering gyroscope, an instrument based on the inventions of Elmer A. Sperry, of New York City, and is an adaptation of the gyro-compass now extensively employed. It steers a vessel along any predetermined course without the aid of human hands.

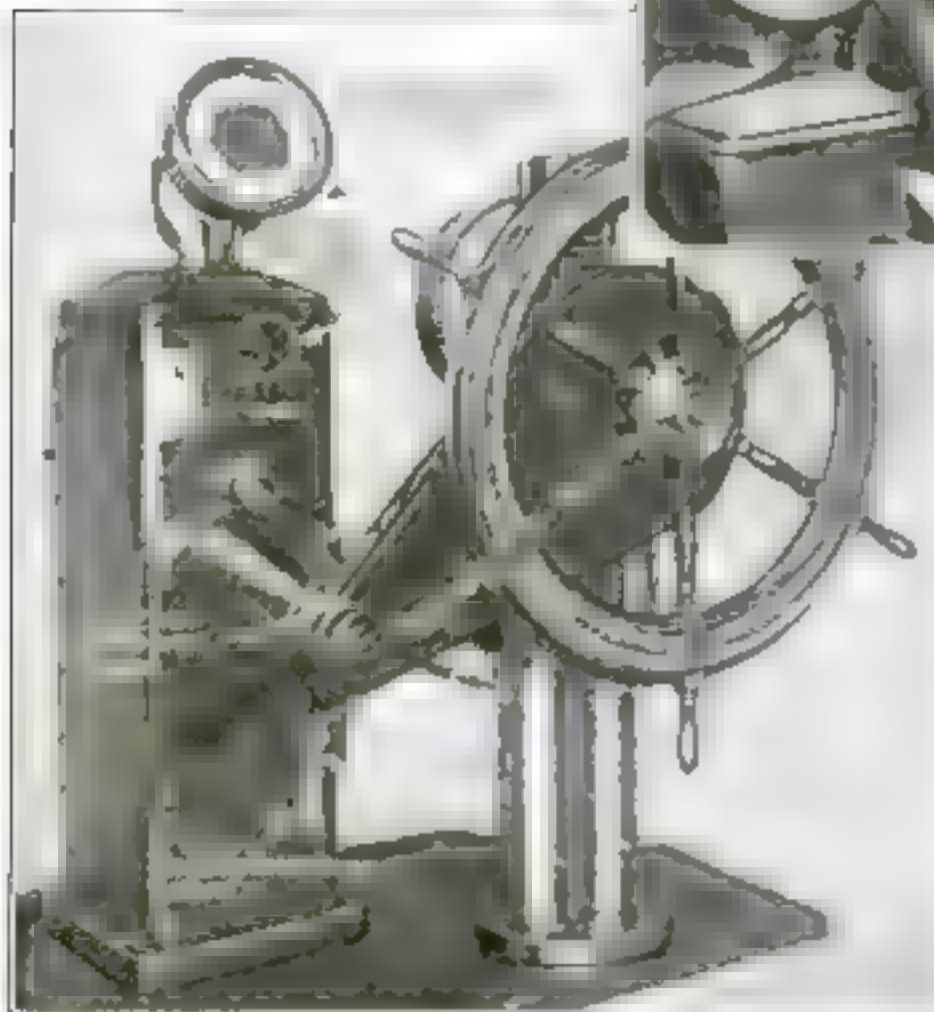
A ship equipped with a master gyro-compass may have, in addition, bearing recording, and steering repeating compasses that operate under the influence of the master. When these repeating compasses have been

been made practical. While the master compass keeps an accurate account of all angles in the ship's course in relation to the earth's meridian, the steering repeater utilizes this account by adjusting the steering mechanism so that the program of the ship will conform to those angles. Thus, should a variation of five degrees be required, the ship will be turned until the master compass records a five-degree angle with the meridian.

The manufacturers claim that the "mechanical quartermaster" has steered ships over 4000 miles, with less deviation than is obtainable with the usual steering gear.



Above: The "mechanical quartermaster" or steering gyroscope steers the ship automatically along a predetermined course.



At left: How the new automatic steering instrument controlled by a master gyro-compass is connected with the pilot wheel that it controls.



Ring of Alarm Clock Switches Off Lights

TO SWITCH off the lights automatically in show windows of stores after closing time an ingenious alarm clock control has been invented by William Frisby, of Colchester, England.

The device, which can be fastened to any ordinary snap switch, consists of a hinge attached to the switch, two chains, a ring, and an ordinary alarm clock. When leaving the store at the closing hour, the manager sets the alarm and hooks the ring at the end of the chains over one end of the alarm winding key. When the alarm goes off, the key turns, thereby releasing the ring and causing the clock to fall a short distance.

The pull of the falling clock causes the hinge on the switch to strike the contact button and the electric current is thus turned off.

Raw Starch Is Digestible

IT WAS generally believed that raw starch was harmful, and that all starchy foods must be thoroughly cooked to be digested properly by human beings. This has been disproved in experiments conducted by the Department of Agriculture.

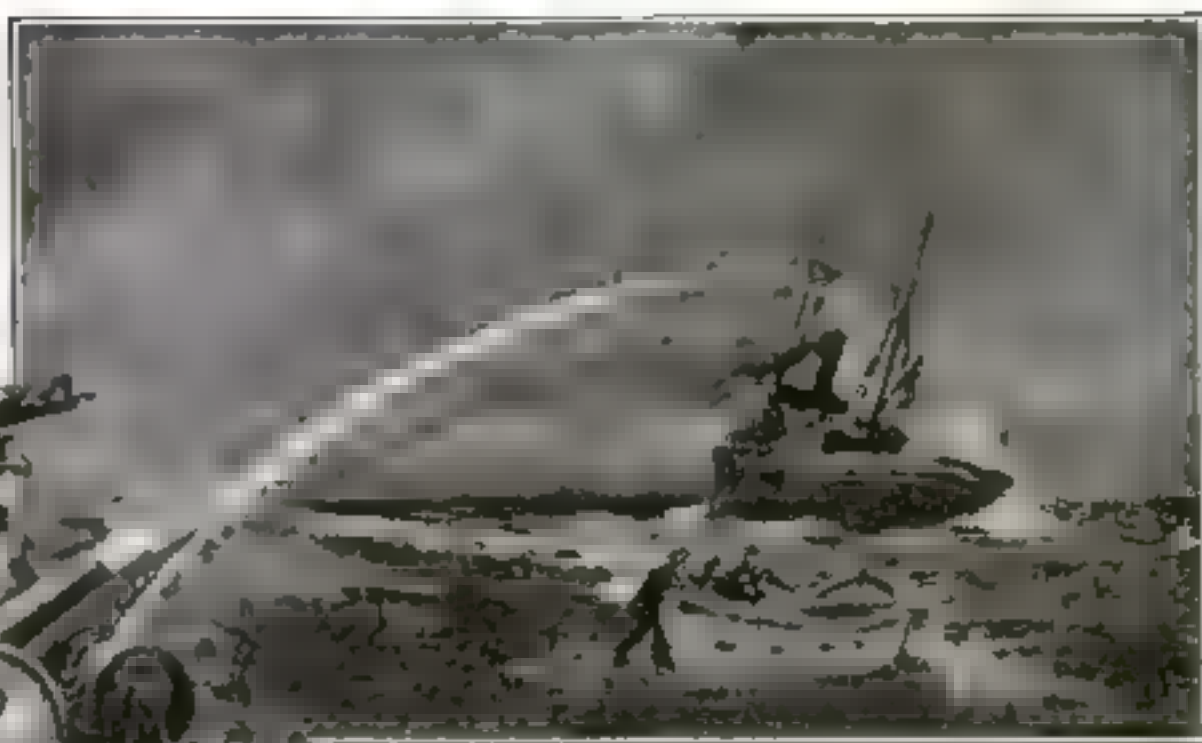
Cornstarch, wheat starch, and rice starch were all completely digested when eaten in a frozen pudding in which they constituted 20 per cent of the entire dish.

Illuminated Lifeline to Aid in Shipwreck Rescues

TO AID coastguards in tracing the shot-line of a breeches buoy when it is shot out to a stranded ship at night, J. D. Bowers has submitted to the United States Government an invention which he claims will illuminate a line sufficiently to inform the men on shore whether it has crossed the ship's deck.

Illumination is obtained by coating the line with dissolved rubber containing a very small amount of radium plus a chemical or mineral that will shine under the influence of radium rays. Other coating materials that are phosphorescent after they have been exposed to bright sunlight or to artificial light, have been suggested.

The invention is expected to solve one of the chief difficulties in shooting the lines accurately.



Coated with a phosphorescent substance, the shot-line forms a streak of light in the night to tell the lifeguards whether it has crossed the deck of the stranded ship.

Midget Cyclecar Coupé Marks Radical Step in Auto Design

ALL conventional rules of automobile construction have been thrown overboard in a startling new development of the small cyclecar designed by two British motor enthusiasts—a streamlined midget coupé that stands no higher than a man's shoulder, runs on top gear at a walking pace, and travels at a speed of 55 miles an hour.

Engine Mounted on Vertical Shaft

The most tradition-defying feature of this air-cooled four-seater is its power plant. The engine is mounted within the streamlined tail—and on a vertical shaft. It is of the radial type, its five cylinders placed in a radial position around the shaft. The cylinder casings, resembling those of an ordinary motorcycle engine, are equipped with vanes that catch the cold air as it is projected downward by fan blades attached to the rim of the horizontally rotating flywheel surmounting the drive-shaft.

From the drive-shaft, the power is transmitted through a single disk clutch direct to separate wheel shafts. Three speeds are provided and are controlled in the usual way from the driver's seat. Since the drive-

shaft is vertical, the usual means of lubrication cannot be employed and therefore a pump system was installed. Oil is forced up through a series of spiral grooves within the shaft, and wells over when it reaches the top. Flowing down along the shaft, this oil lubricates all the bearings on its way to the sump well. Since the engine is air-cooled, no water need be carried. The gasoline is kept in a tank situated under the hood.

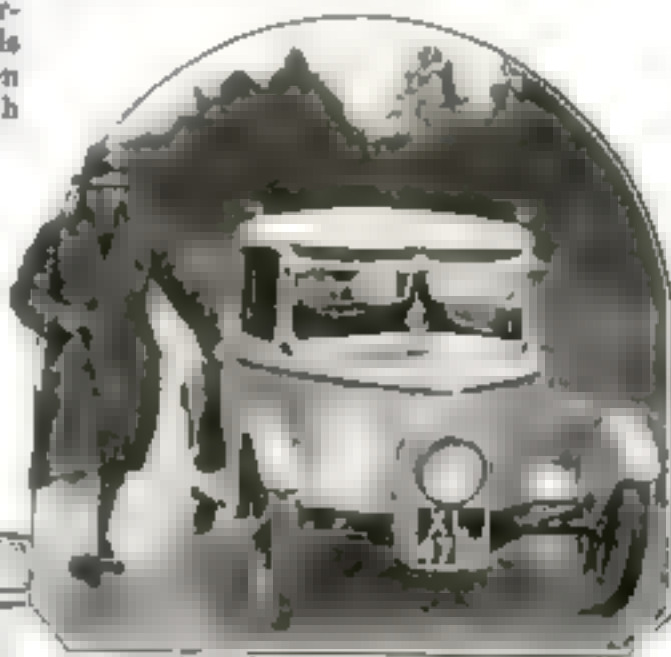
In place of the usual single rear axle, each rear wheel is mounted by roller bearings on a short stub axle. The front wheels are also separately mounted and when turned, they carry the mudguards with them, for the suspension that supports the wheels serves as the mounting for the guards.

The body and chassis form a single unit. A six-inch aluminum section, to which the runningboard is integrally fastened, forms both the side of the body and the side supporting member.

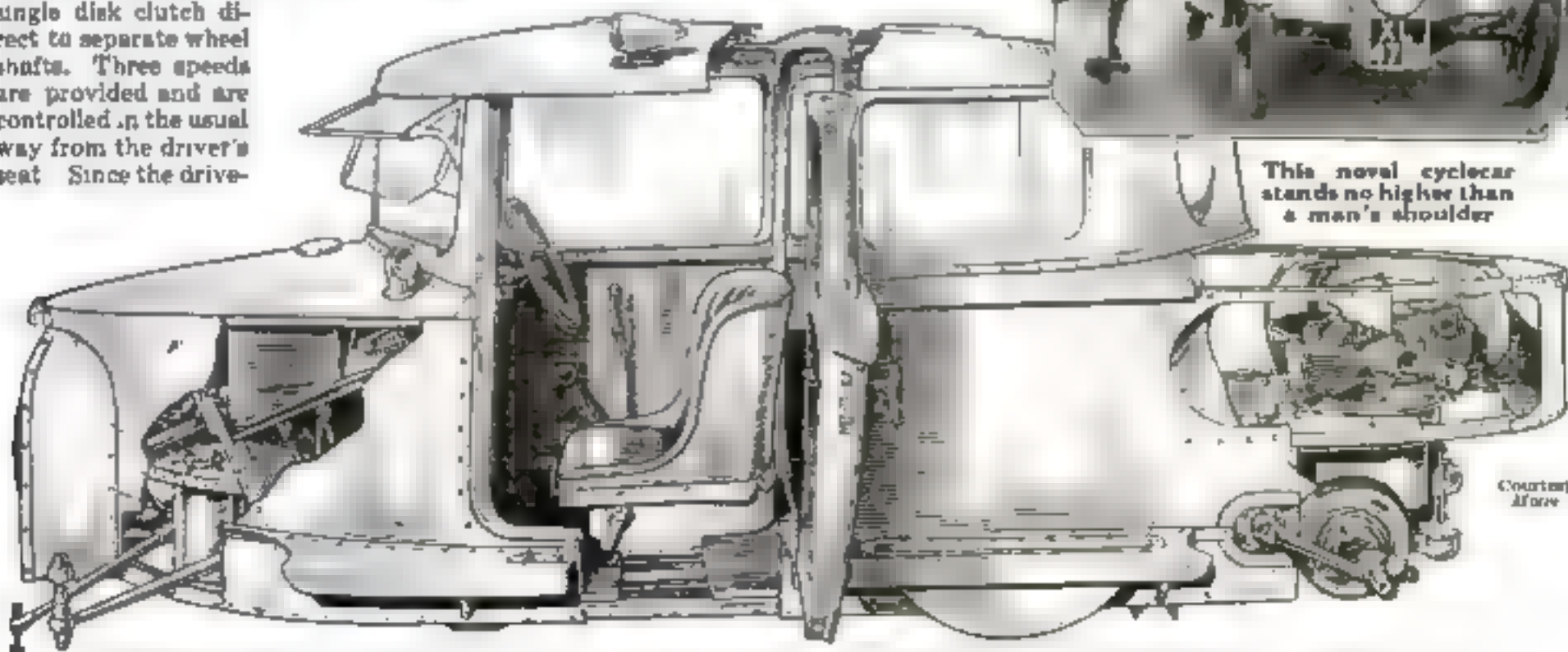
Shocks are absorbed not by springs, but by an ingenious hydraulic method.

When the wheel is projected upward, it moves a piston within a cylinder filled with oil. This oil is forced through a beveled orifice against the reaction of a small spring. This dampens every shock, resulting in exceptional riding qualities over the roughest roads.

The unusual suspension is such that the load comes midway between the wheels and the center of gravity is very low. This even distribution provides exceptionally comfortable riding.



This novel cyclecar stands no higher than a man's shoulder.



Courtesy
Afron

This cutaway view shows vertical mounting of the engine at the rear and other extraordinary features of the new cyclecar.

How Engineers Build a Tunnel Miracle

Boring the World's Largest

ARMED with keen, knifelike edges, four gigantic steel cylinders bore like moles beneath the Hudson River, cutting their way, inch by inch, through sand and solid rock and building steel-lined burrows behind them. Two of them strike out from the New York shore, westward bound, two from the New Jersey side, eastward bound.

Slowly, a few feet a day, the westward bound borers and the eastward bound borers creep toward each other. When, after three years of stupendous labor and skill, they join at last, far beneath the river bed, they will have completed one of the greatest engineering feats in history—the construction of two immense under-river highways nearly two miles long, through which 50,000 vehicles will pass each day.

Digging a \$30,000,000 Burrow

In those three years they will have removed nearly half a million tons of rock, gravel and silt. In the burrows behind them will have been placed 115,000 tons of cast iron and 130,000 feet of concrete lining. At least \$30,000,000 will have been spent (preparations alone have cost not less than \$2,000,000), and hundreds of hardy caisson workers—"sandhogs"—will have risked death and disease.

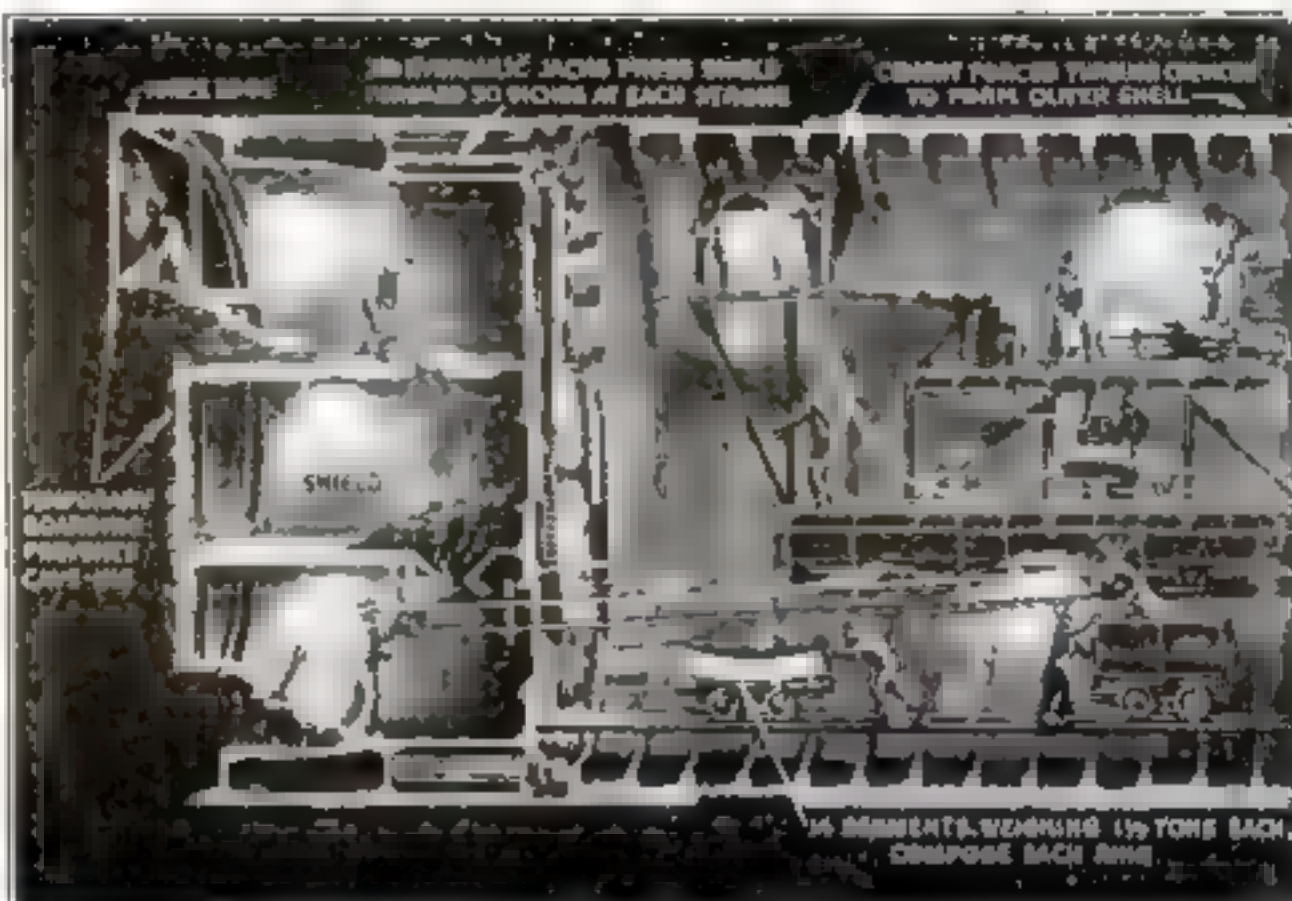
Imagine a tin can 30 feet in diameter and 18 feet long, with both ends knocked out and a partition or bulkhead dividing it into two chambers, the forward chamber twice as long as the rear one. Picture this can as made of steel weighing 400 tons, armed with a cutting edge in front—and you have an idea of one of the boring shields for the new Hudson traffic tubes.

Where Sandhogs Work under Pressure

In the forward compartment the sandhogs, working with pick and shovel, chop away the earth and rock ahead of them and pass the loosened material on conveyors back to the rear chamber. These men labor under terrific air pressure—60 pounds to the square inch sometimes—to prevent water, sand and muck from engulfing them.

And as they bore ahead, gradually chopping a passage under the river, hydraulic jacks fitted into the bulkhead, thrusting with irresistible power, force the 400-ton cylinder forward. Again and again this titanic operation is repeated, advancing the great shield about $2\frac{1}{4}$ feet a day through rock, or 15 feet a day through silt.

Meanwhile, at the tail of the shield,



How "sandhogs," working in a steel cutting shield, bore under the Hudson

a huge arm lifts 3000-pound segments of a cast iron ring and fits them in place within the rim of the shield to form a new section of the tunnel tube. Each ring is made up of 14 segments six feet long, with a key segment at the crown of the arch, all bolted together with 180 10-pound bolts. All joints of the segments are caulked and any voids between the exterior of the ring and the surrounding silt, rock, or sand are filled in with cement forced from the interior of the tunnel under high air pressure.

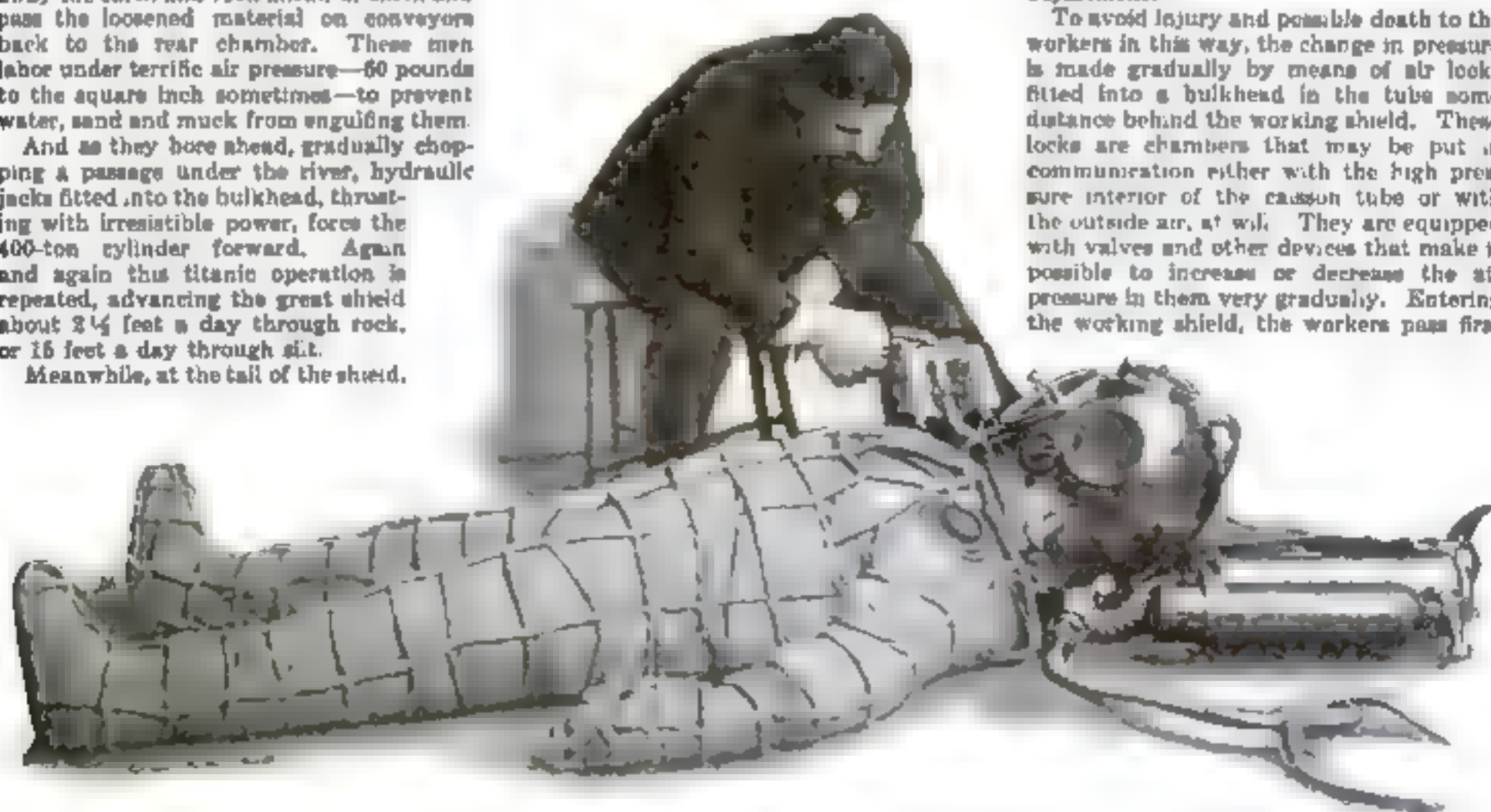
Each cast iron circlet that makes up one 30-inch length of the tube weighs 22 tons, and the whole outer shell of the two under-river highways will weigh 115,000 tons. And this is only part of the total, for at 800-foot intervals there will be huge

concrete caissons, and the tube itself will be lined with tile, reinforced with concrete and paved with granite. Even at that, it may be necessary to tie the whole thing down with additional sinkers!

Workmen Brave Dread Disease

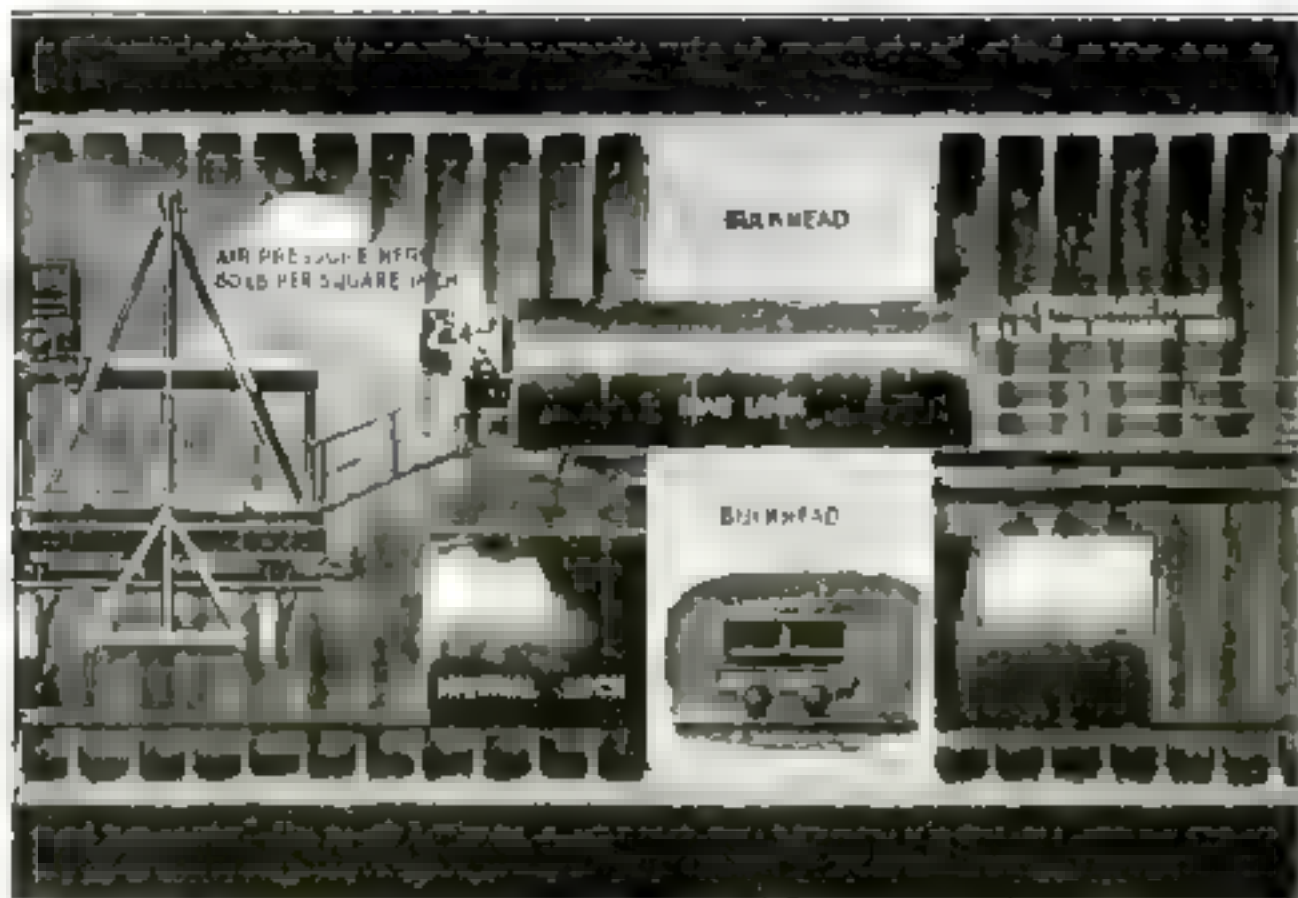
The sandhogs work in pairs—a miner and his helper. They must be unusually hardy men, constitutionally able to withstand terrifically high air pressures. Changing from one air pressure to another often causes what underground workers call "the bends," otherwise known as caisson disease, caused by the presence in the blood of too much nitrogen. The change in pressure becomes too rapid to allow the human machinery to keep itself in proper adjustment.

To avoid injury and possible death to the workers in this way, the change in pressure is made gradually by means of air locks fitted into a bulkhead in the tube some distance behind the working shield. These locks are chambers that may be put in communication either with the high pressure interior of the caisson tube or with the outside air, at will. They are equipped with valves and other devices that make it possible to increase or decrease the air pressure in them very gradually. Entering the working shield, the workers pass first



Curing the "bends," caused by sudden change in air pressure. The patient is placed in a pressure suit and subjected to the same air pressure that caused the disease. This pressure is then gradually reduced.

Underwater Motor Highway



and build a huge cast iron tube as the shield slowly advances

into the air lock. The doors of the lock are then tightly closed, and the pressure within is slowly increased until it becomes equal to that under which the work is being done in the tube. When the workmen leave the tube, the operation is reversed.

When a workman is attacked by the "bends," he becomes as helpless as if he were dead drunk. For a cure, he is placed in a tank or a pressure suit and subjected to the same atmospheric pressure that caused the disease. Gradually the pressure is reduced to normal and the "bends"—if the patient lives—vanish.

Preparations for work on the Hudson traffic tunnels began last fall. They included costly experiments to discover adequate means of ventilating the tunnels when completed—a problem unusually difficult because of the extreme length of the tunnel and the necessity of drawing off exhaust gases from the thousands of motor vehicles that will pass through.

The United States Bureau of Mines, working with Dr. Yandell Henderson, consulting physiologist at Yale University, decided that to make the tunnels safe from poisonous carbon dioxide gases, the air

Workmen Risk Death to Complete Feat

should contain not more than four parts of carbon dioxide to 10,000 of air. The fresh air, it was decided, will be forced by blowers, housed in buildings above four ventilating shafts for each of the tunnels, into ducts beneath the tunnel roadways, pass through flues to continuous expansion chambers out across the roadway and slowly ascend to the ceilings. The air will remain in the tunnel on an average of 90 seconds and carry the exhaust gases away.

What Traffic Will Be in 1940

The first of the great boring shields started on its way last November from a concrete caisson shaft at the foot of Canal Street, New York. According to present plans—and the work thus far has progressed without a hitch—the two tubes, $1\frac{1}{4}$ miles long from portal to portal, will be completed by Jan. 1, 1926. As soon as the tunnels are ready for service, it is estimated that 17,000 vehicles will pass through them each day. After six years of operation, this number will be increased to 24,000 a day; and by 1940 it is believed that the tubes will accommodate 50,000 vehicles every 24 hours.

When completed, the great vehicle tunnels are expected to help solve the living problem for millions. Motor trucks passing through the tubes will carry tons of food products from New Jersey farms and warehouses to the Manhattan consumer.

The tunnels will be a triumph of the motor truck for short hauls. They will relieve thousands of week-day delivery drivers and more thousands of Sunday tourists, from the tedious journey across the Hudson by ferry.

Press a Button, and Automatic Phonograph Plays Your Tune

AN AUTOMATIC magazine type phonograph, recently invented by Oberlin Smith, of Bridgeton, N. J., is controlled from a switchboard which can be moved to any part of the house. By pressing any two buttons on the board, the operator can play any one of 50 records, or he can repeat any record again and again without moving from his chair. One of the buttons selects a record, while the second starts the machine.

In the operation of the machine there are four stages that follow each other automatically. When the two buttons are pressed, the current from the house circuit is turned on to provide the power, and a cylindrical drum, containing vertical slits in which the various records rest, turns around until stopped by a magnet controlled by the selective switchboard circuit. The disk record desired is then in position to be raised vertically from the drum by a rectangular frame.

All You Do Is Listen

As the disk emerges from the top, it is grasped by two jaws which swing it into a horizontal position upon the phonograph turntable. The jaws are then released and the turntable starts rotating. The needle is slowly lowered to the edge of the record, following the grooves to the end of the record. The machine is then stopped automatically and the operation is reversed,

thus returning the record to its original place in the drum.

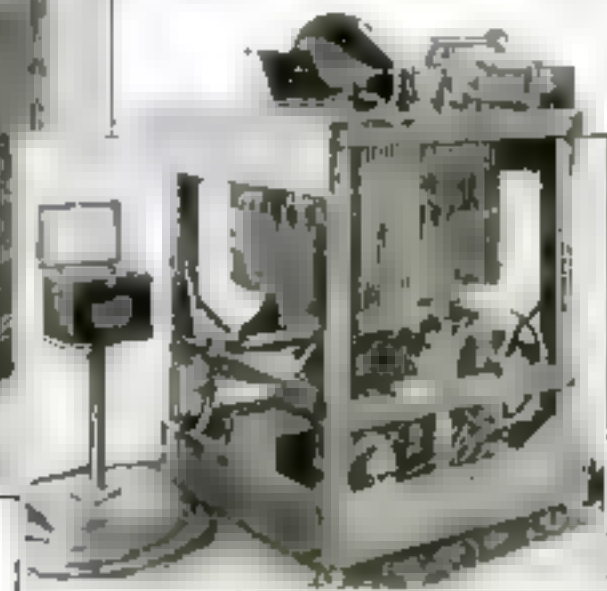
The location of the needle for starting and stopping any particular record, is

governed by a wooden pin, which is inserted with the record in a hole in the turret. Thus for a 12-inch record having a four-inch run, a rod of definite length is inserted. When records are changed, new pins are used. These pins can be made of old pencils or doweling material.

The selection of a record by pressing one button, and the starting of the operation by pressure on a second button, locks the switchboard until the record is finished. Then all buttons spring up, indicating all clear for another record.



The mechanism of this magazine type phonograph, with switchboard, is shown at the right



Quarter Million Stamps Form Mosaic

IT TOOK 250,000 cancelled postage stamps and a generation of labor to complete a novel mosaic, entitled "Philatelia," by W. Reichelt, an artist of Teplice, Czechoslovakia.

The picture, portraying a woman gathering poppies, contains a collection of postage stamps of all the nations of the world—a wide variety being necessary to obtain the desired color combinations. Many stamps more than 100 years old were used. American stamps formed the poppies while British aviation stamps made up the blue sky background.

The mosaic has been insured against burglary for \$100,000, and was held in the New York Customs House for several months after its arrival in this country because no one could be found who could place a valuation on it with any degree of accuracy, it being a unique work of art.



Of 250,000 stamps coloring this mosaic, American stamps form the poppies and British aviation stamps the sky

Sponge Spreads Mucilage from This Container

THE mucilage bottle has long been an annoyance because of the difficulty of keeping the mucilage in proper condition while still providing a ready means of using it neatly.

A New York concern has recently marketed a container the top of which is provided with a sponge. Inverting the bottle causes the mucilage to flow into the sponge, which serves as a spreader.



Hawaiian Plantation to Combat Leprosy

IN THE battle of science to stamp out the plague of leprosy, plans are now under way to establish in the Hawaiian Islands a plantation of taraktogenon trees. The oil obtained from the seed of this tree—chaulmugra oil—has been responsible for hundreds of cures of the dread Oriental disease, thanks to discoveries made by two London doctors nearly 20 years ago, after much research.

It is largely due to the daring of Joseph Rock, one of the adventurous agricultural explorers of the United States Government, that enough of the seed has been obtained to form the nucleus for an extensive grove of these trees, according to Henry C. Fuller in his new book, "The Story of Drugs" (Century Co.).

Car Sides Are Track for Unloader

THE problem of quickly unloading railroad cars filled with loose building and similar materials has been solved by a recently invented portable car unloader, that is now put into practical use in many cities on the Pacific Coast.

Loose materials are often shipped to the railroad sidings in open top gondola cars. Formerly the labor of several men and a cup scraper or a derrick were necessary to unload these cars. Now, however, it is done quickly and efficiently by the portable unloader, which is designed so that it can be assembled on the car and operated by two men. It is equipped with its own power unit and is capable of loading a five-ton truck in five minutes.

The device consists of a bucket conveyor supported by a steel framework resting on a three-wheeled truck using sides of the car as a track. The bucket conveyors may be raised to the top of the car and lowered as they eat into its contents. Raising the material, they drop it into a pipe chute, which conveys

it into the truck that is waiting below.

The entire apparatus moves from car to car with ease, on rails that bridge the gap between cars. Only one man is needed to operate it. Its designers claim it is the most efficient device for unloading materials from a gondola car that has been invented. It is equipped with either an electric or gasoline motor, according to requirements.



Mounted on wheels that run on the sides of the car, this bucket conveyor unloads material as shown above



World's Largest Handsaw Cuts Rolls of Paper

A 48-inch handsaw, said to be the largest in the world, has been built by an Eastern manufacturer for special use in cutting through rolls of paper wound tightly on brass tubes.

Many of these paper rolls are 24 inches in diameter, while the brass tubes usually are two inches thick with one-sixteenth-inch walls. The mighty sweep of the saw blade goes through the machine rolled paper and the brass tube as well.

The blade of this saw is about twice the size of the ordinary handsaw blade, and the tool stands as high as a small boy.

Rented Goats Clear Missouri Farm Land



By ones and twos, the kids are staked to wooden pup tents while their mothers are out foraging.

Like an army camp is this Angora goat stock farm in Missouri where land clearing animals are raised.



This Angora buck eats almost anything.

FOR RENT: Four thousand Angora goats for the season at 50 cents a goat. Guaranteed to clear farm lands of undergrowth and rubbish.

That sounds like one more version of the ancient wheeze about the goat and the tin can. But it's not a joke at all for Ely Ashcraft, a farmer of Stone County, Mo.; it's a science developed into a good paying proposition. In fact, Ely's financial success in raising Angoras in pup tents, then leasing them out to nibble uncleared farm land, has induced fellow members of the American Angora Goat Breeders' Association to follow his example.

Goats Yield Threefold Income

And the farmers who rent the goats are profiting, too. They are saving manual labor that would cost them many times the rental price of the goats.

The goat breeders profit three ways. First, the rent money; second, free meals for the Angoras; and third, a substantial income from the mohair yielded by the rubbish eaters.

From two to five goats are usually assigned to clear an acre—depending on the density of the underbrush. When the brush is tall, the tops are cut off, and the goats nibble the leaves, impoverishing the plants and causing them to die.

Faring forth from their pup tent encampments, these shaggy armies are now advancing on Texas, Missouri, Arkansas, Louisiana, Oregon, Washington, Arizona, and New Mexico, reclaiming valuable farm lands. In the Willamette Valley in Oregon large troops of the animals are being used successfully on reclamation projects. In fact, the prolific fruit orchards in the Pacific northwest are, in a measure, testimonies to the success of this form of animal husbandry.

For rearing the Angora kids, the novel shelters pictured at the top of this page originated in Louisiana, where goats are

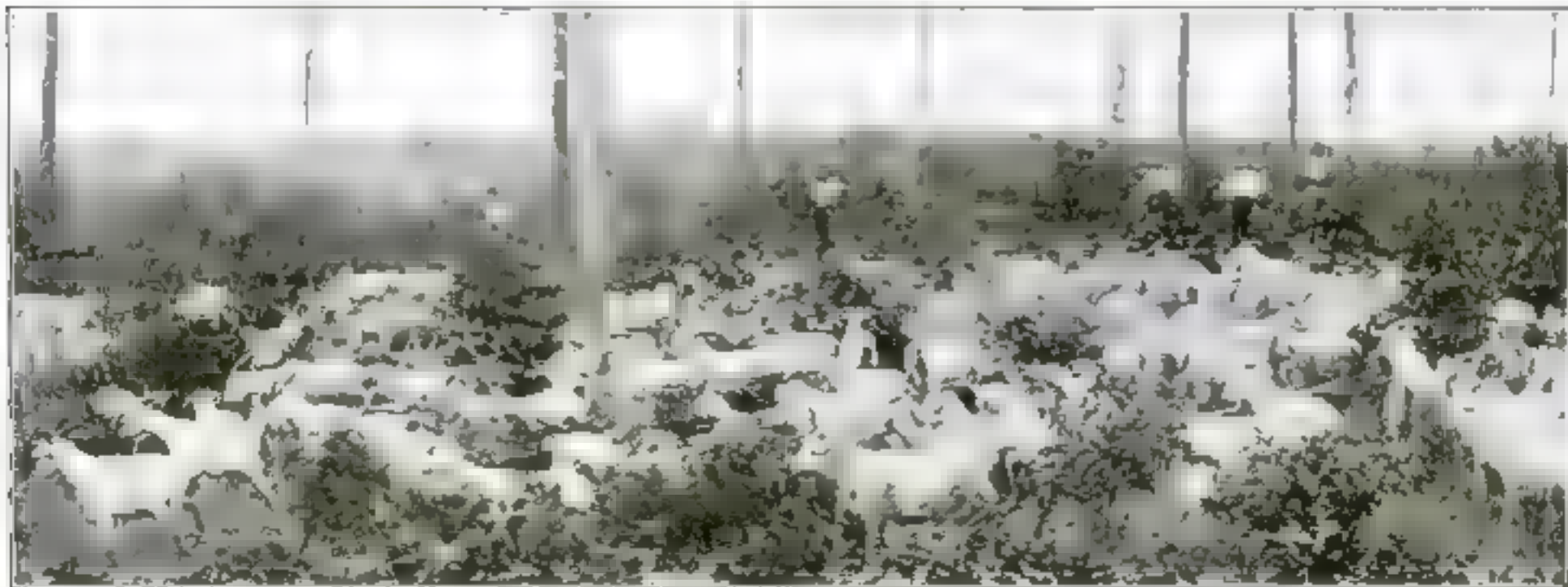
being used extensively to clear cut-over lands. One by one or two by two—it all depends on size—the baby goats find shelter beneath small wooden tents, patterned after army tents, while their mothers are out foraging. At each tent the kids, wearing halters, are leashed to stakes in the ground.

Where They Come From

Twice a year the goats are robbed of their fleece by mechanical shears.

The Angora goat had its origin in Asia Minor, in regions from 1000 to 4000 feet above the level of the sea. Mild climate, adequate drainage, wholesome drinking water, and space for comfortable bed grounds are the essentials for goat ranges. Winter feed in more severe climates and plenty of underbrush are needed. Goat shelters on the ranges are usually simple in construction, consisting of low sheds with metal roofs boarded at one or two sides.

The Angora breed yields offspring once a year. October is the best breeding time.



On the march—a herd of Angora does nibbling undergrowth from cut-over lands in Missouri.

Oblong Lens Detects Counterfeits



Placed on the inclined glass of this reflector box, a suspected bill or check is highly magnified in one dimension by a curved lens shown at right.

TO MINIMIZE the loss of cashing altered checks and counterfeit bills at banks, a New York concern has recently placed on the market a magnifier that enables the teller to determine immediately any deviation from the design of a genuine bill or from a genuine signature on a check presented at the bank.

The magnifier consists of a reflecting box in which is mounted an electric lamp. Rays passing up through an inclined glass at the top of the box, upon which the bill is placed, pass through a curved lens which magnifies the bill in one dimension only. The resulting distorted image permits ready detection of differences in the location of silk threads

in a bill. Bleached counterfeits show up very plainly.

Any alterations of a check examined in this way are highly magnified, while forged signatures can be detected by superimposing two checks, one bearing a signature which is known to be authentic.

The magnifier may be attached to any electric light socket.

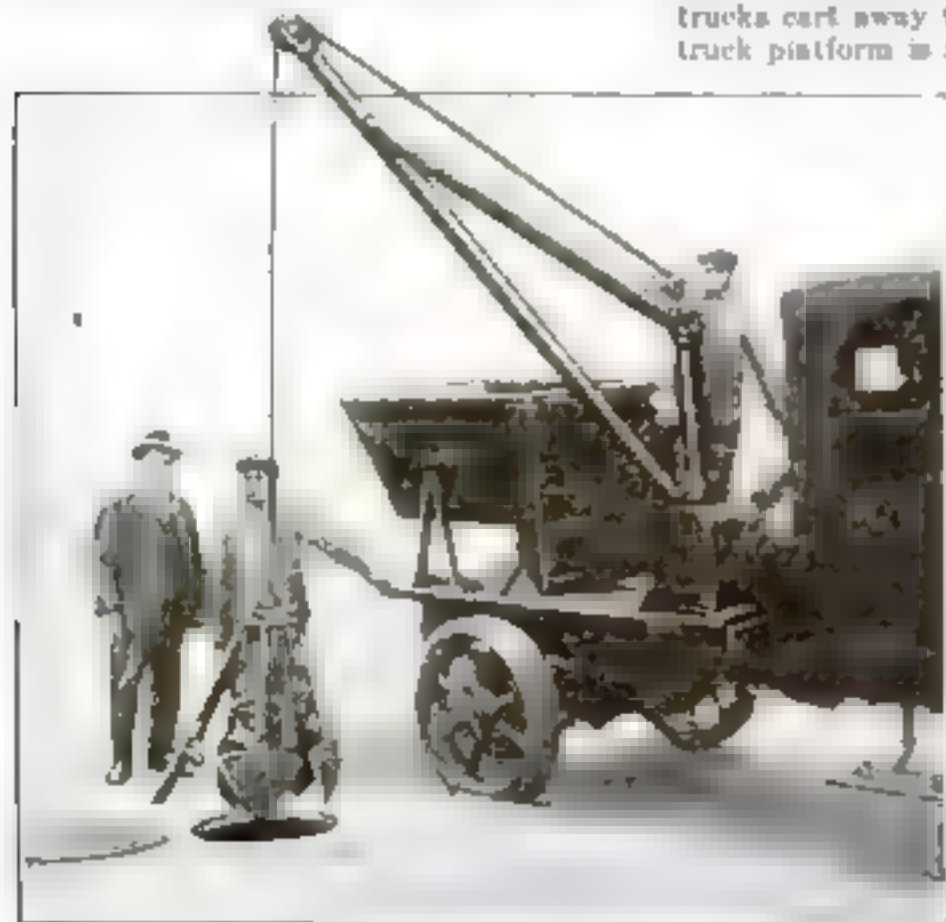
Motorized Grab Bucket Cleans Sewers

A MIDGET grab bucket of the orange peel type, which does away with the odious task of cleaning sewers or manholes by hand and so cuts the cost of the labor, has been invented by P. J. Healy, of New York City, and is being successfully used in

cleaning out the basins in Perth Amboy, N. J.

The machine consists of a motor truck upon which is mounted an especially designed dumping body into which the grab bucket discharges its load and from which trucks cart away the material. Upon the truck platform is a mast and boom, from the end of which is suspended the bucket. The mast is so mounted upon bearings that it can swing the bucket into any position, thus making it unnecessary for a workman to go down into the sewer.

The grab bucket, operated by the truck engine, is suspended from three cables, one for lowering and the others for opening and closing the leaves of the bucket. A series of tests have shown that catch basins can be cleaned in from 20 to 30 minutes by the grab bucket, where hand labor would require hours. A further advantage is the rapidity with which the device can be moved.



Courtesy the Commercial Vehicle

Suspended from a boom attached to a motor truck, the grab bucket is driven by the truck engine.

Artificial Sunlight for Small Aquariums

TO SUPPLY

the small home aquarium with artificial sunlight, a Chicago inventor has designed a fish bowl with electric light

attachment that floods the fish with color rays of which they are usually deprived when taken from their natural surroundings.



Car Jumps Back on Track

IN A remarkable accident on the North-eastern Railway, near Stannington, England, recently, a derailed car, after breaking nearly 1000 of the fish-plates that hold the rails to the ties, jumped back on the rails while the train was speeding at 60 miles an hour.

The car was part of a fast freight. The astounding feature of the accident was that the train continued at its high speed.

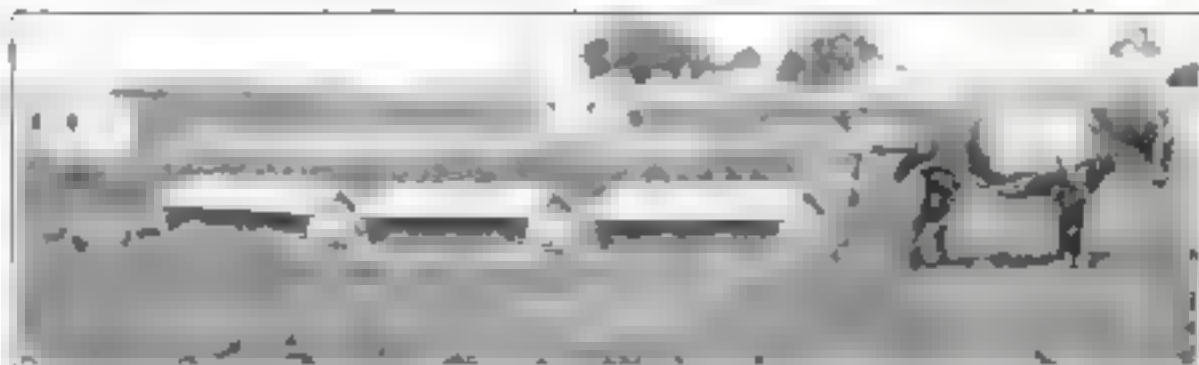
Auto Hoisted to Window on Seventeenth Floor



IN ORDER that a coupé automobile, which was a prize in a recent Chamber of Commerce campaign in Omaha, Neb., might be exhibited in the rooms of the organization, it was necessary to hoist it 17 stories, remove a window to admit the car, since no elevators were large enough to carry it.

Chickens Eat "Cafeteria Style" on Uncle Sam's Poultry Farm

THE popularity of the "help yourself" plan of dining is not limited to humans. On the 80-acre chicken farm maintained by the United States Department of Agriculture, at Beltsville, Md., the cafeteria style of eating is practiced in satisfying the appetites of approximately 4000 fowls. Here Uncle Sam conducts feeding and breeding tests that supply valuable information to poultry raisers throughout the United States.



Self feeding hoppers on runners are coupled together and hauled from place to place on the government farm. The chickens help themselves

These chicken cafeterias, or self-feed hoppers, are built on runners—an arrangement that permits easy removal from one place to another on the farm. A group of

the cafeterias may be linked together with chains and drawn by horses to any portion of the poultry experiment station.

The self-feed hopper is an open trough arrangement in which the various rations are deposited. The chickens help themselves to whatever variety of food their appetites may dictate. This method of feeding poultry not only saves labor on a large ranch, but also prevents waste of feed.

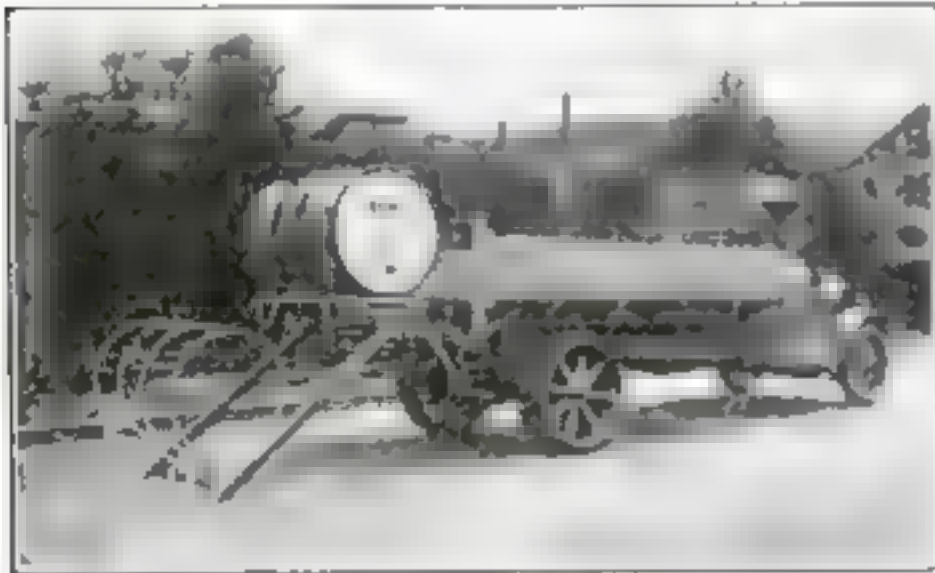
Hand Crank Runs Simple Truck Loader

IN ORDER to facilitate the loading of trucks, a Swiss concern has perfected a loading winch that raises an elevating

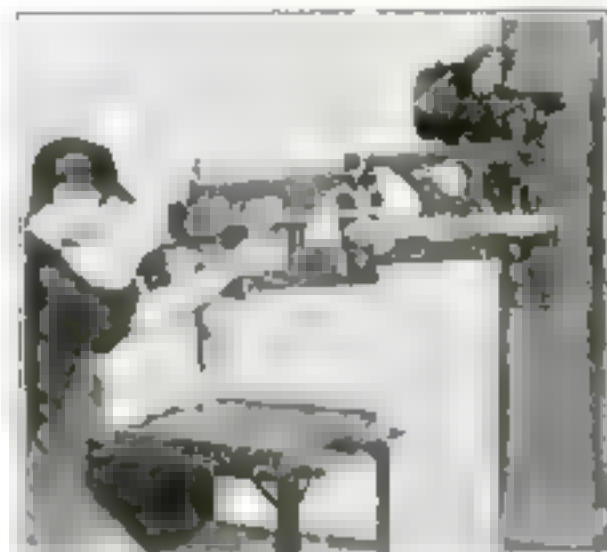
platform along two skids up to the level of the truck bottom.

When lowered, the platform is seven inches above the ground. This is sufficiently low for a barrel or crate to be rolled or tipped upon it. A winch, operated by hand with a crank, raises the loaded platform along the skids until it is level with the truck floor.

When not in use, the attachment is removed by releasing two hooks from eyes set in the rear of the truck body, and it can be placed for use on another truck or folded and stored.



Rolled on an elevating platform, a barrel is hauled up skids to the truck floor by turning a hand crank



Motor Driven Bracket Drill for Small Workshop

A SIMPLE, inexpensive post bracket drill, suitable for operation within a radius of 3 1/4 feet, has been perfected recently by a concern in Cleveland, Ohio, to provide a useful addition to the small workshop of the mechanic or garage owner.

Operated by a small electric motor, the machine is especially adapted to the manufacture of stoves, as well as electrical and switchboard work. The drive is through tight and loose pulley countershaft and bevel gears to an upright shaft near the post. Belts transmit this power through pulleys. Two arms are provided, giving great flexibility of adjustment.

To operate, the work is placed conveniently within the maximum radius of the machine, the arms are loosened and the spindle is then centered over the work. When the proper position has been secured, the arms are locked in place and the spindle is caused to rotate by throwing the belt from the loose to the tight pulley on the power shaft.

Starving to Death

WHAT happens when persons starve to death? Starting new information on the subject has been supplied by Dr. George B. Haman, a nerve specialist of Chicago, who recently returned to the United States from Russia with the brain of a man who died of starvation.

Investigations by scientists indicate that the starving body first feeds on surplus fat and waste matter. Proportional losses at death are:

Fat, 97 per cent; muscle, 80 per cent; liver, 56 per cent; spleen, 63 per cent; blood, 17 per cent; nerve centers, 1 per cent.

Auto Speeders Checked Automatically

A SPEED control mechanism for automobiles has been invented by Col. Charles Gore, of Los Angeles, Calif., to automatically check a car from exceeding a specified speed limit, notifying the driver when the limit is reached, and registering the attempts made by the chauffeur to exceed that limit.

Like a speedometer, the attachment is actuated by the turning of the car wheels. The register does not begin to function until the maximum speed as previously set is approached. Then a red lamp flashes and a buzzer sounds.

After these two signals, any increase in speed shuts off the motor, which cannot be started again until the driver presses a button on the side of the case. This pressure is transmitted to a recorder which makes a permanent mark to indicate an attempt at speed violation.

While the device is especially applicable to trucks whose owners desire to keep their chauffeurs driving within the safe speed, it can readily be adapted to all kinds of motor vehicles.



On this speed arrester, red lights flash and a buzzer sounds when the driver exceeds the speed limit

Fisherman Goes to Sea with a Horse and Wagon



UTILIZING the tides to trap fish, Warren Burgess of New Brewster, in the Cape Cod section of Massachusetts, has established what he calls a "fish farm." He "harvests" his catches with a horse and wagon.

Nearly two miles out to sea on the flats Burgess has erected weir nets or fish traps, the netting being supported by sturdy stakings. Into these weirs the fish are lured at high tide, when the sea is at the tops of the nets, and when the tide recedes with the tide, they are left trapped in the nets. At low tide the water is so shallow that Burgess can reach the nets and bring in the fish.

Nearly 5000 poles are used in several traps Burgess has placed. He makes immense catches of herring, eel, and other fish.



How horse and wagon harvest fish trapped in nets at low tide

Newest Sport Combines Football, Basketball, and Soccer

SPEEDBALL—an exciting game for everybody, combining skill, speed, and teamwork—is America's latest

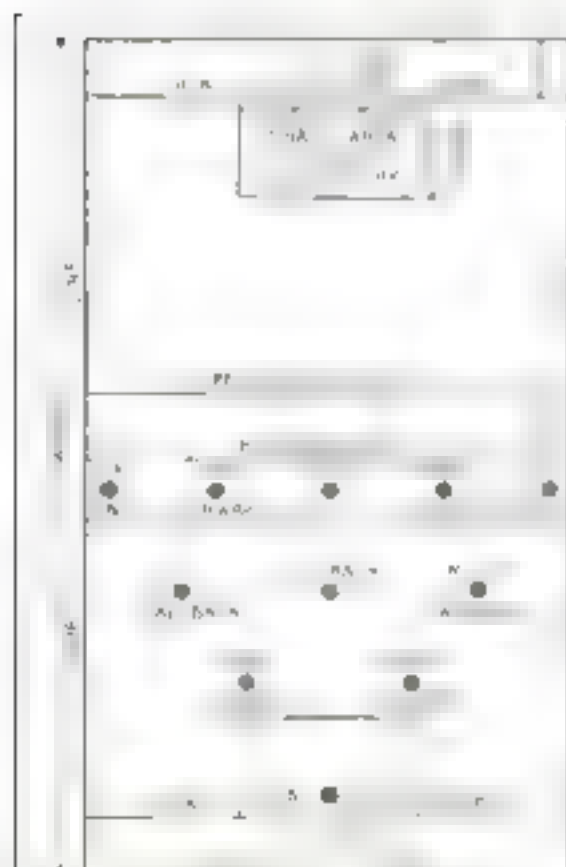
sport. Borrowing the forward pass, punt, and drop kick of football, the passing of basketball and the kicking, dribbling, and fast charging of soccer, the new combination game has become immensely popular at the University of Michigan, where it was invented by Elmer D. Mitchell.

Speedball is played on a regulation football field, with a regulation soccer ball. There are 11 men on a side. The object of the game is to kick the ball into the goal.

The positions of the players on the offensive team at the kick-off from mid-field are shown in the accompanying diagram. Their opponents must keep at least 10 yards from the ball, or behind their restraining line.

The kicking team charges behind the ball, just as in football. As long as the ball rolls along the ground, soccer restrictions hold and no man on either team may touch it with hands or forearms. But a fly ball may be caught, passed to a team mate, punted, or dribbled in the air—that is, thrown up and caught again.

Opponents can huck a man with the ball, but may not tackle him.

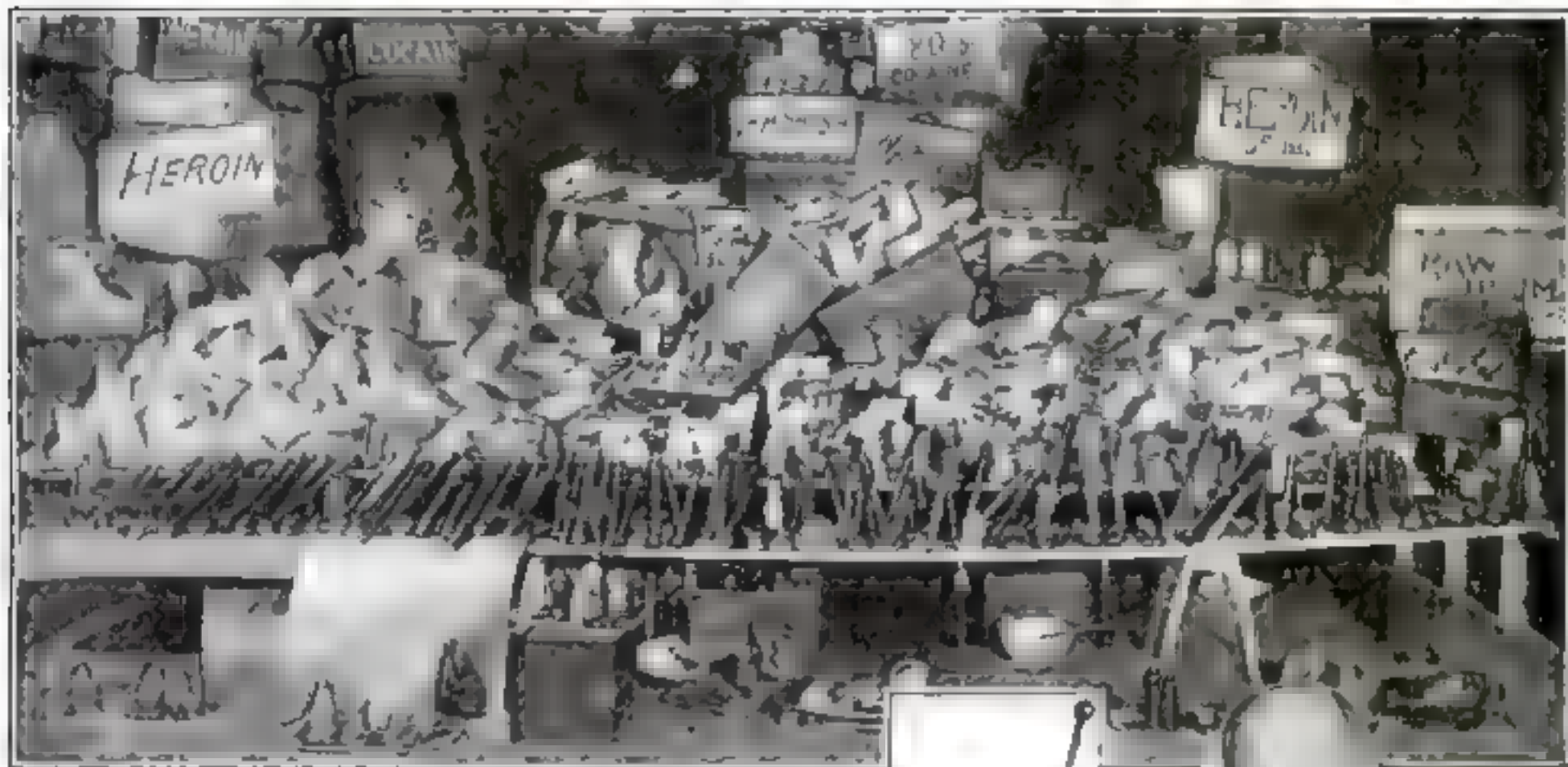


A tense moment in speedball passing. Diagram A shows the positions of the players at the start of a play. A fly ball may be caught, passed to a team mate, punted, or dribbled in the air—that is, thrown up and caught again.



DOPE

Where It Comes From; How It Is Made, and Its Effect on the Nervous System



*An Interview with DR. CARLETON SIMON,
Deputy Police Commissioner of New York City, Narcotic Division*

By Lorry Jacobs

READ what Doctor Simon says of drugs and drug addiction. He points out that there are enough victims of narcotic habits in the United States to populate a city the size of St. Louis. And the number is increasing!

For years Doctor Simon has been one of the country's foremost authorities on habit forming drugs. He is the unofficial head of nationwide forces fighting to control the dope evil.

The photograph above, for example, depicts just a small portion of the narcotics and accessories seized by members of Doctor Simon's staff in recent months. At present market prices the value of the supplies shown would exceed a million dollars.

Doctor Simon tells here how seemingly innocent plants are responsible for the horrible drug habit that menaces the manhood and womanhood of the United States. His picture of the physical and mental effects of narcotics is terrifying.

WHY is America now wrestling with the greatest problem since prohibition—dope?

What terrific fascination lies in habit forming drugs to make America the greatest user of dope in history?

These are questions uppermost in the minds of nearly all Americans because of the almost unprecedented publicity the problem has received recently.

The enormity of the problem has not been exaggerated. At the most conservative estimate of the United States Treasury Department, a million people in this country are addicted to the use of habit forming drugs. This means one out of every 110 people. We use more than 40 times more narcotics than any other white nation, and 17 times more per capita than the Chinese.

Supporting this estimate is the fact that in 1919, although we could legally absorb only one ton of opium in this country, we actually imported 36 tons.

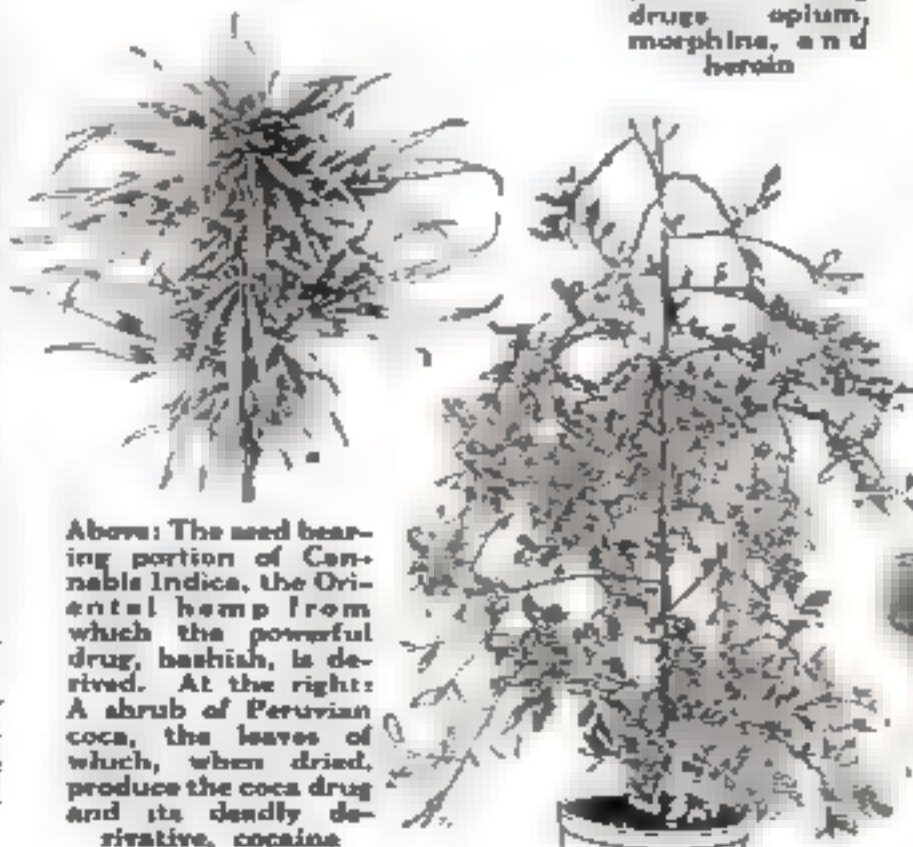
Where do these drugs come from? How are they made? How do they act on the human body?

From three plants—in themselves innocent enough—are obtained the devastating habits that are dangerously undermin-

(Continued on page 54.)



Above is the Oriental poppy, harmless in itself, yet the source of three of the most vicious habit forming drugs—opium, morphine, and heroin.

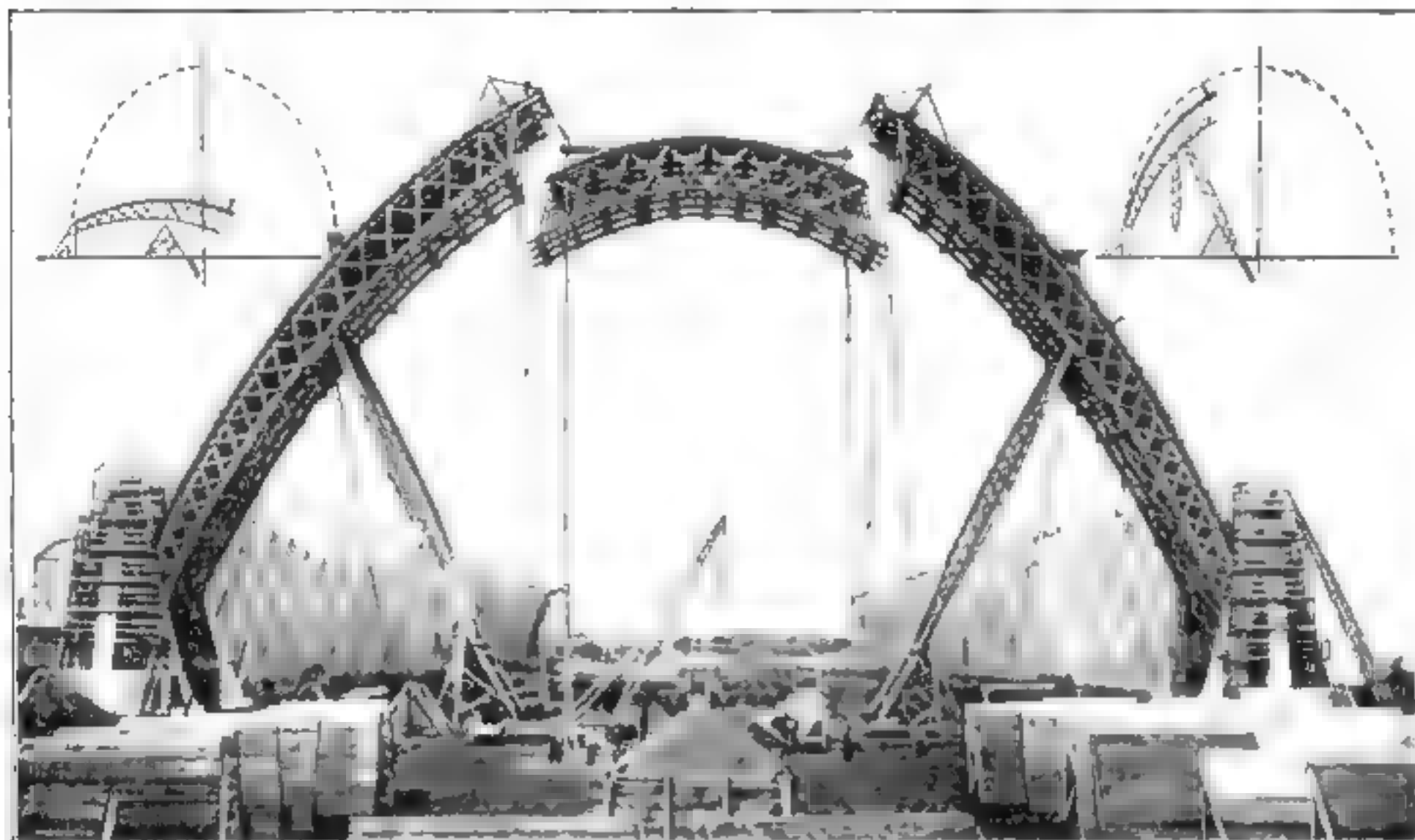


Above: The seed bearing portion of *Cannabis Indica*, the Oriental hemp from which the powerful drug, hashish, is derived. At the right: A shrub of Peruvian coca, the leaves of which, when dried, produce the coca drug and its deadly derivative, cocaine.



Dr. Carleton Simon and a typical opium pipe.

Giant Airship Hangar Hoisted without Derricks



Hoisting the key truss into place. The small diagrams show how props of different lengths jack up the two main trusses

GIANT trusses for each of two airship hangars under construction in the suburbs of Paris, and said to be the largest of their kind in the world, are being erected in a novel way. They are assembled on the ground and then hoisted into position, the center section being erected in the same manner as that of the ill-fated Quebec bridge.

Each truss is 174 feet high and 260 feet

wide, hinged at each end. About three eighths of a truss is completed on the ground, and is then pushed upward by jacks. The opposite section is then raised and both are fastened in a position slightly higher than that in which they will finally rest. The center or key section is then assembled and hoisted between the two main sections by cables attached to pulleys fastened to the upper ends of the other

sections. When the key has been placed, the outer sections are lowered against the center and the three sections riveted together.

In raising the outer sections, the jacks exert pressure on the structure through a number of props. When a jack has gone as far as it can, a longer prop is inserted and the pressure is transferred to this from a second jack.

Dope

(Continued from page 53)

ing American life. From the poppy of China and India come opium and its derivatives, morphine and heroin. From South America come the coca plant and its narcotic derivative, cocaine. And from India, Persia, and China come the hemp (*Cannabis Indica*) and its chief derivative, hashish.

The Oriental poppy and the coca leaf are responsible for about 99 per cent of the drug addiction reported by authorities.

How Opium Is Produced

Take a trip to a typical opium plantation of the Orient, brilliant with poppies, and see how dope is grown and harvested.

The seed pod of the opium poppy, somewhat larger than the poppies we grow in America, is full of milky juice at the time the petals begin to unfold. At this stage laborers on the opium farms pass through the fields, slicing the pods with sharp knives. Through these wounds the sticky juice flows, and as it spreads, it thickens and becomes dark brown in color.

Later, this thick ooze is scraped off the plants and collected into masses, each about the size of a cannonball. These balls form the commercial product known as gum opium. From the crude opium

morphine and codeine are extracted by manufacturing chemists.

From the plantation and the chemical factory, journey now to the opium den and see how it takes about 15 minutes to prepare for the smoke, and about 30 seconds for the actual smoking.

The opium derivatives—morphine, heroin and codeine—usually are taken by hypodermic injection.

The origin of cocaine is far removed from that of opium. The coca tree from which the drug, coca, is obtained, is grown in South America. The drug comes from the leaves that are stripped from the branches and spread out in thin layers to dry. By means of a solvent, the alkaloids, chief of which is cocaine, are then removed from the leaves. Finally, by the addition of a dilute acid, cocaine and other products pass into acid solution. Usually the cocaine addict inhales his drug as a snuff, but sometimes it is taken with a hypodermic syringe.

Cannabis Indica, from which hashish is derived, is simply a species of hemp—one of the few species in the vegetable kingdom that is bisexual. At the ends of its branchlets the female plant develops thick clusters of matted flowers, which at full growth secrete a greenish, sticky resin. When dried and stripped from the stems, these tops form the commercial drug from which hashish is made. This drug may be

smoked, chewed, or drunk, as preferred.

Just what are the effects of the various forms of dope on the addict?

The morphine addict becomes a nervous wreck, irresponsible, purposeless, untruthful, and unfit for bodily or mental effort. As the habit creeps on him, he degenerates and often becomes hopelessly insane. The use of morphine, after about six months, produces symptoms of chronic poisoning. After each hypodermic injection, these symptoms disappear temporarily, to be replaced by a sense of wellbeing, then to return with increased intensity. When the effect of the drug has subsided, there comes a horrible depression. It is this that relentlessly compels the addict to take refuge in excesses of the drug.

Cocaine Addict Becomes Violent

The cocaine addict is much worse than the user of morphine, because cocaine usually produces a kind of dementia that often is expressed in suicidal mania. The cocaine addict will commit violent excesses, and even murder, in his delirium. As the effect of the drug subsides, a stupor follows.

One of the features of hashish use is the reaction of the individual to the factor of time. A cake of soap falling to the floor appears to float, taking several minutes to fall, when, of course, the movement took but a fraction of a second.

Tiny Motor Starts Novel Glider



The new "pusher" sailplane and its small auxiliary propeller motor

WHILE French aviators have been soaring over a gliding horizon, remaining in the air without engine power for more than eight hours at a stretch, a German inventor has been busy perfecting a light sailplane of unusual design equipped with a two-cylinder four-horsepower motor. The motor is merely to give starting speed and insure safe landing.

This important development in soaring flight fulfils the prediction of Augustus Post, secretary of the Aero Club of America, in the November, 1922, issue of POPULAR SCIENCE MONTHLY. He forecast the use of auxiliary motors in future sailplaning.

In the new German machine, the motor drives a propeller less than three feet long, but sufficiently powerful to start the plane on its upward flight. As prophesied in Mr. Post's article, it is no longer necessary for gliders to start from the top of a hill and for aviators to be content to coast into the valleys below. By taking ad-



vantage of air currents, the pilot is able to manipulate his sailplane in such a way that altitudes much higher than the starting point can be reached.

In appearance the new auxiliary glider resembles the earliest airplanes in that it possesses a set of small wings in front of the main spread. These bow wings are used when the driver desires to change elevation.

The plane is of "pusher monoplane" type—that is, the engine and propeller are in the rear, and push the plane through the air.

Does Your Sense of Touch Play You False?

DID you know that besides optical illusions, there are illusions of feeling? The proof is very simple. Take a small round pellet about the size of a pea. Cross the middle finger over the first finger in such a way that the tip of the middle finger is on the thumb side of the first finger. Now insert the pellet between the crossed fingers and roll it about the surface of the table. You will be astounded to find that you distinctly feel two objects about half an inch apart.

The explanation of the experiment rests in the fact that the pellet is touched by the opposite sides of the two fingers, and, consequently, two sensations of touch arise instead of one.

Switch in Handle of Trouble Lamp

SQUEEZING the fingers between the guard wires on a trouble lamp to turn on the switch has caused so much annoyance in the past, that a manufacturer in Valparaiso, Ind., has decided to eliminate this difficulty by placing the switch in the handle where it is within easy reach of the thumb.

Constructed with the usual guard, reflector and hook for hanging, this lamp will prove convenient for garage mechanics and others who work around automobiles because of the ease with which the current can be turned on and off. It would also be found useful in the home.



Poisonous Mushroom Reaches Full Growth in Twelve Hours

ONE of the most amazing instances of rapid plant growth is found in the case of the fly fungus or *Amanita muscaria*, which reaches full maturity within 12 hours after its cap first pierces the surface of the ground. In general appearance this mushroom resembles the edible type, but it is extremely poisonous, for it has a large content of muscarine, a poisonous alkaloid. Eating one of these fungi by mistake will

produce vomiting, general spasms in the abdomen, and finally death.

All fungi of this species grow on the ground, the fly fungus preferring woodland

areas. Underneath the cap of this species is a series of plates or gills on which are produced the spores. It is this that distinguishes the poisonous types.



At 6 a.m.



At 11 a.m.



At 1 p.m.



At 4 p.m.

Electric Log Tells Ship's Speed

A NEW electric submerged log, by which it is possible to gauge accurately the distance a ship travels in a given length of time, is the invention of Captain Chernikeef, lately chief hydrographer of the Russian Royal Navy. Manufacturers of the device claim that it places the gaging of distance on the same plane as the gaging of direction by the compass and the gaging of time by a chronometer in navigation.

The log consists of two main parts: one inside the ship's skin, the other submerged outside. The apparatus is held in place by a flange, bolted to the ship's skin and serving to divide the external and internal part of the log. The internal part is simply a sluice valve that closes the aperture when the log proper is withdrawn. The valve is supported by a tube that has at its extremity a handle used in withdrawing the log.

The part of the log exterior to the ship's hull is a gun-metal supporting arm that has at its extremity a conical seating carrying a main bearing and shaft on which a vaned screw propeller is fixed. Through the inside tube and the outside arm an electrically insulated cable passes. The vaned screw, by means of worm gears, drives a commutator, or make and break dials, which is contained in the forearm. Running entirely through the apparatus and to the bridge of the ship, where the recording instrument is usually located, is a cable that



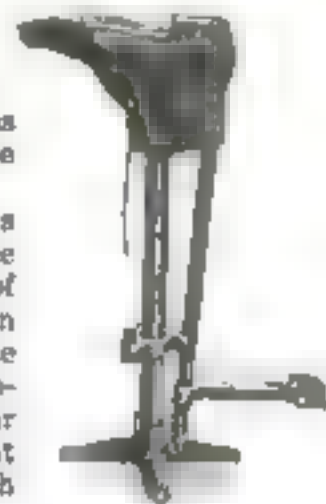
The electric log and its position in ship's bottom

carries current supplied by a dry battery. The action of the make and break circuit as it is affected by the revolutions of the vaned screw, reveals the speed of the boat.

Self-Holding Last for Shoe Repair at Home

A SELF HOLDING shoe last, which makes it unnecessary for a cobbler to hold the shoe with one hand while working on it with the other, has been invented by John S. Butcher, of Vineland, N. J., for use by persons who repair their own shoes, as well as by professional shoe repairers.

The holder is equipped with three lasts, the smallest of which is used when applying heels. The shoe is placed in position and the rear brace locked, so that the cobbler has both hands free.



Human Kidney Is Complex Filtration Plant

MICROSCOPIC instruments of marvelous workmanship and the development of a very fine technique in handling them have made possible the discovery by Prof. A. N. Richards and Dr. O. H. Plant, of the University of Pennsylvania, that in the human kidney there is a microscopic filtration plant of extreme complexity.

The blood flows through the finely divided network of blood vessels in the kidneys to many thousands of microscopic filters, they find. The blood passes over the heads of these filters under considerable pressure; some water and waste products pass through them, ultimately being excreted, while the bulk of the blood passes back to the main blood stream.

Every increase in the amount of waste products eliminated is accomplished by increase in the pressure of the blood on these filters.

Electricity Makes New Wine as Mellow as Oldest Vintage

OF COURSE this is out of date in America, but—a French professor, Dr. Charles Henry of the Sorbonne, Paris, France, has just perfected a method of aging wines by electricity!

The usual process of aging consists of breaking up certain chemical compounds to form other compounds. The union of these chemicals with oxygen is necessary to bring about the change. In the time-worn method, oxygen is obtained through the pores of wooden barrels, and the process is a slow one.

On the principle that oxidation takes place at one of the terminals or electrodes of an electric circuit, Doctor Henry has equipped a wine-filled barrel with an anode and cathode having a difference of potential, or voltage, of from 60,000 to 120,000. The oxidation is very rapid—20 years of actual aging is accomplished, it is claimed, in a few hours. Experts claim that liquors aged by this process are equal in flavor to vintages aged by the years.

French experts believe, too, that electrical oxidation will eliminate the harmful effects of new liquors that so often prove injurious to drinkers because of the presence of certain poisonous bacilli. Electrical treatment is said to kill these decomposing bacilli, while permitting the formation of those harmless chemical

combinations that give the beverage the mellow taste found in properly aged liquors.

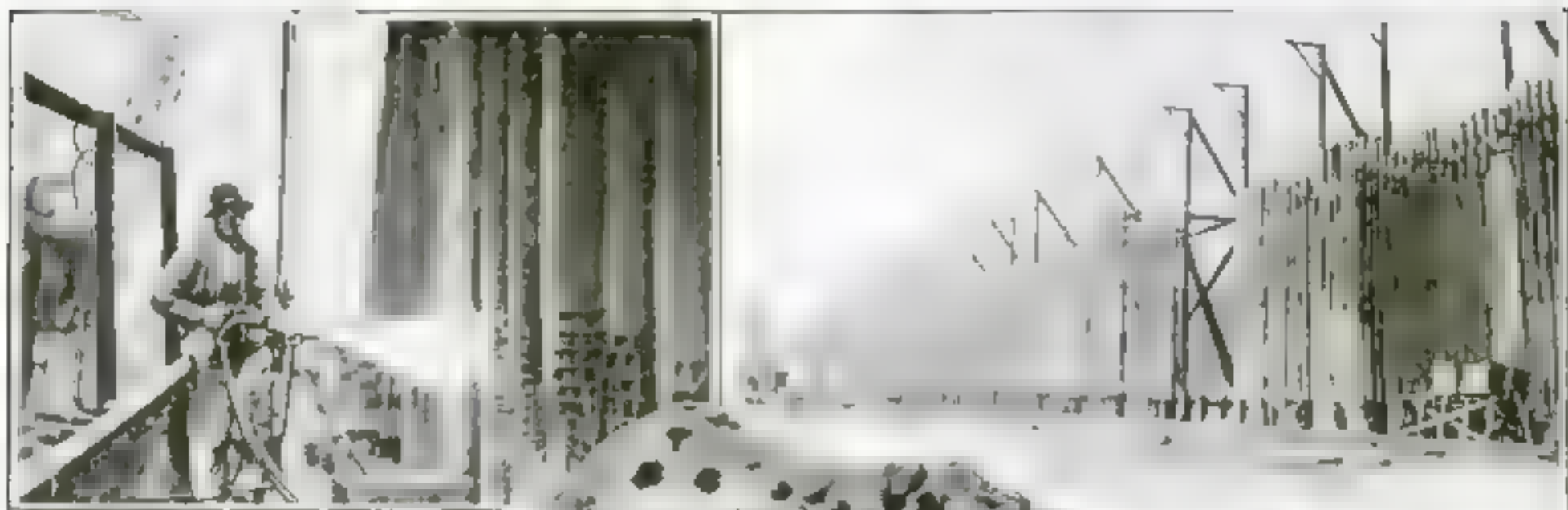
While physicians disagree as to the harmful effects on the body of alcoholic beverages that have not been allowed to

age, recent analysis of 100 samples of liquors seized in West Virginia revealed that most of them were dangerous for human consumption because of the most objectionable forms of decomposition found in them.

Here is the electrical apparatus for aging wine, and its inventor, Dr. Charles Henry, of the Sorbonne, Paris



Concrete Armor to Protect Piles from Borers



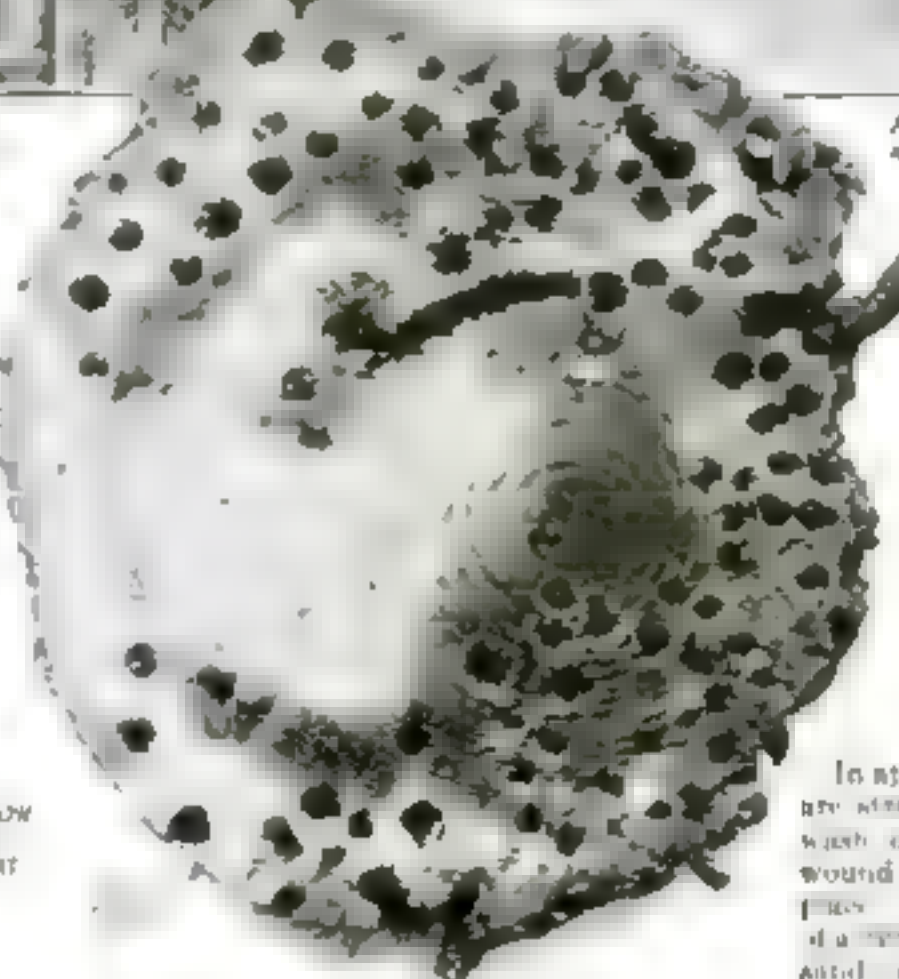
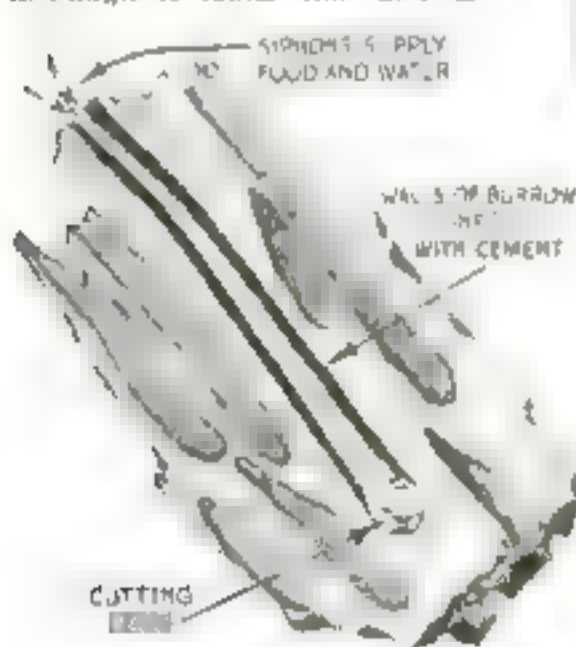
Covered with steel mesh reinforcement, the wooden piles are sprayed with concrete from cement guns.

A line of piles strung on framework at Tacoma, Wash., to receive a coating of concrete armor.

IN AN NO. 1000, a new method of protecting piles from borers is being used.

The teredo, which is the most dangerous of these borers, is a mollusk, although it looks like and is often erroneously referred to as a worm. It lives in burrows that it drills into submerged timbers with sharp cutters at the front end of its shell. These burrows are made just deep enough to permit the teredo to leave a siphon-

often erroneously referred to as a worm. It lives in burrows that it drills into submerged timbers with sharp cutters at the front end of its shell. These burrows are made just deep enough to permit the teredo to leave a siphon-



Section of wooden pile honeycombed by boring teredos, as shown at left.

often erroneously referred to as a worm. It lives in burrows that it drills into submerged timbers with sharp cutters at the front end of its shell. These burrows are made just deep enough to permit the teredo to leave a siphon-

The pile extending upward into the water. Through this siphon the teredo draws water containing the minute food particles upon which it lives.

As the boring action of the shells is slow, it is possible to use an extremely fine powder, which although often found in the water, is not harmful to food.

For some time creosoting has been used as protection. While successful against some types of borers, it has many drawbacks, chief of which is its toxicity.

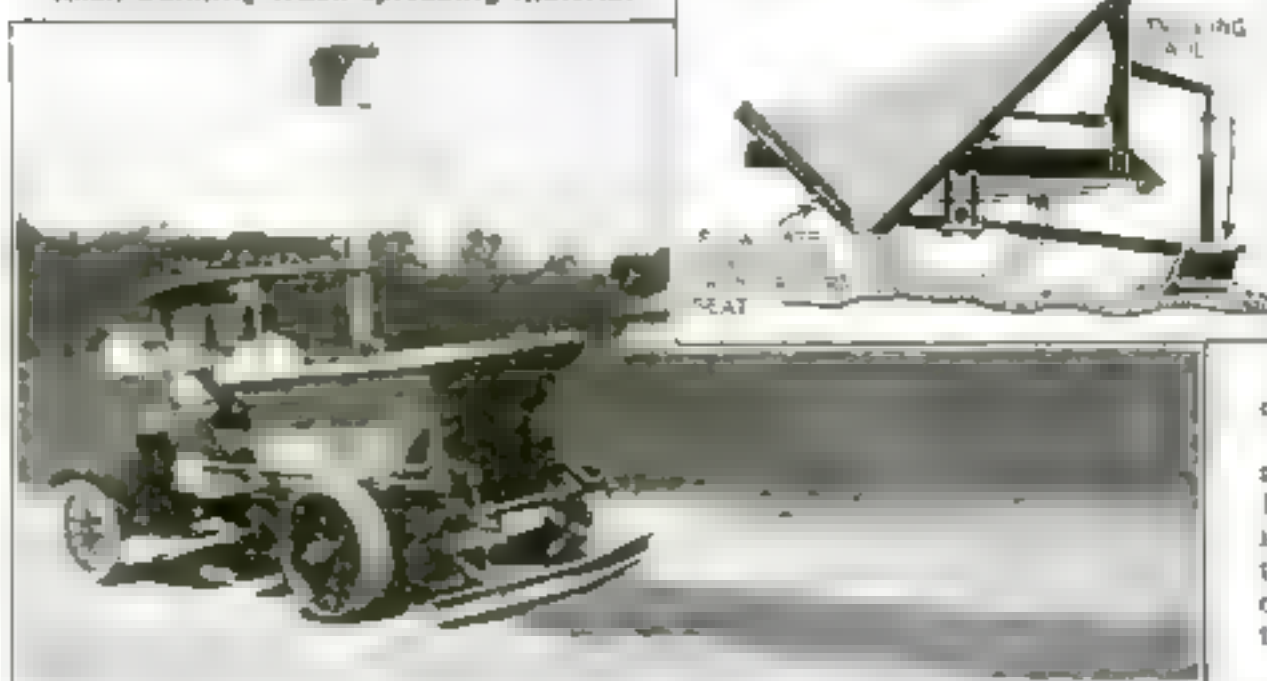
In applying the cement coating, the piles are strung on framework and are kept wet with sea water. A wire mesh is wound around the wood and fastened in place. From cement guns concrete made of a mixture of one part cement to two parts sand is shot against the surface so that it will just cover the mesh. After drying, another coating is applied, increasing the thickness of the concrete to two inches. Only the upper portion of the pile is coated, for the part driven into the ground requires no further protection. Tests prove that borers cannot penetrate a two-inch concrete armor. In addition, the concrete covering serves as a resistant to fire.

Automatic Road Building Truck Spreads Gravel Evenly

FOR highway maintenance work, a truck with a hopper body and adjustable scraper, recently placed upon the market by an Ohio concern, transports and automatically spreads gravel or other road material without the aid of hand shoveling.

The truck has a capacity of three tons of material and is constructed in the shape of a hopper, with a long narrow sliding gate forming the front sloping side of the body. By opening this gate, the driver from his seat controls the flow of material from the hop-

Road-building truck spreading material.



By opening a flow gate in the hopper, the driver controls the flow of material, as shown in diagram. An adjustable blade levels material.

per and thins the depth to which the material is deposited on the road.

An adjustable scraper attached to the rear axle and also controlled from the driver's seat, aids in spreading the material and levels it over chuck holes and deep ruts in the road.

The machine travels at a rate of from 12 to 15 miles an hour and it is claimed that it equals the amount of hauling ordinarily requiring six teams and wagons.

The truck also is used to pull light road graders.

Portable Jointed Tube Bridge Travels on Wheels

AN EXTRAORDINARY portable bridge, built of interchangeable tubes and designed by Major C. E. Inglis, of the British Royal Engineers, is finding considerable peacetime use because of its extreme lightness, strength, and easy and rapid erection across a river or impassable gorge.

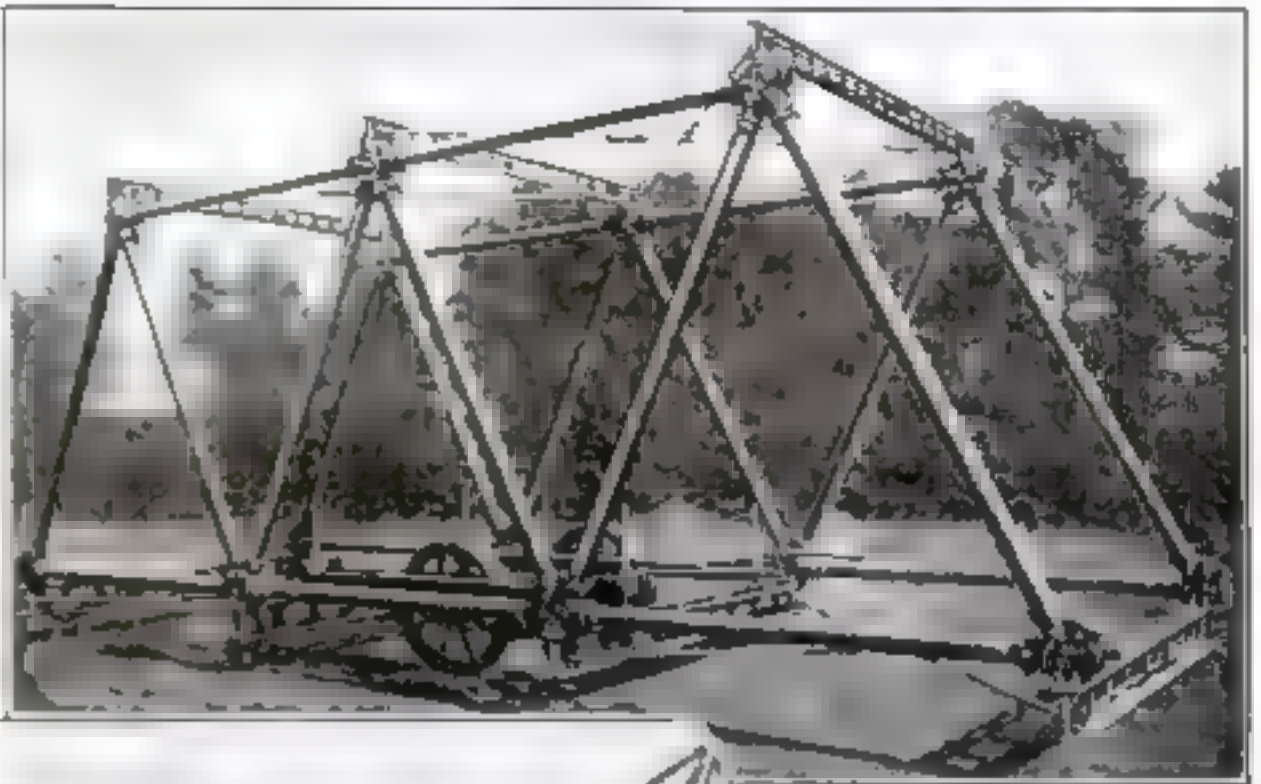
The bridge may be erected either at the site or, a 100-foot span can be erected on a two-wheeled trolley and wheeled to its destination.

In each of several standard types all the girder members consist of interchangeable tubes of the same length and size. The floor transoms are interchangeable as are the joints to which the tubular members are attached.

In the lightest type, main girder diagonal members form equilateral triangles with the top and bottom flanges or booms. The bracing members are on such an angle that a single line of tubing serves as the top boom. Floor transoms or cross girders may be of timber or steel, and are bolted to plates that form part of the cast steel joints.

To the end of each tube a steel eye end is screwed and on this eye end a collar or nut is screwed.

The joints into which the tubes fit are formed with circular sockets all of the same diameter, set at angles to receive the eye ends of the tubes. At each end is inserted, a pin is slipped through holes in the tube and socket and the collar is screwed up, fastening the joint. Longi-



Above: Portable bridge assembled on wheels. At left: Two foot bridges joined to support a roadway between them.



tudinal timbers are laid on the transoms to form the footwalk or roadway.

A span of 98 feet weighs 214 tons and will carry a distributed load of 6 tons.

The triangular type may be used upside down to form a deck bridge, the flooring being laid along the top.

How Movie Screen Shows Heart Throb of Embryo Chick

WHAT the motion picture has done in depicting the operations of human life it now promises to do in portraying invisible, microscopic life in action.

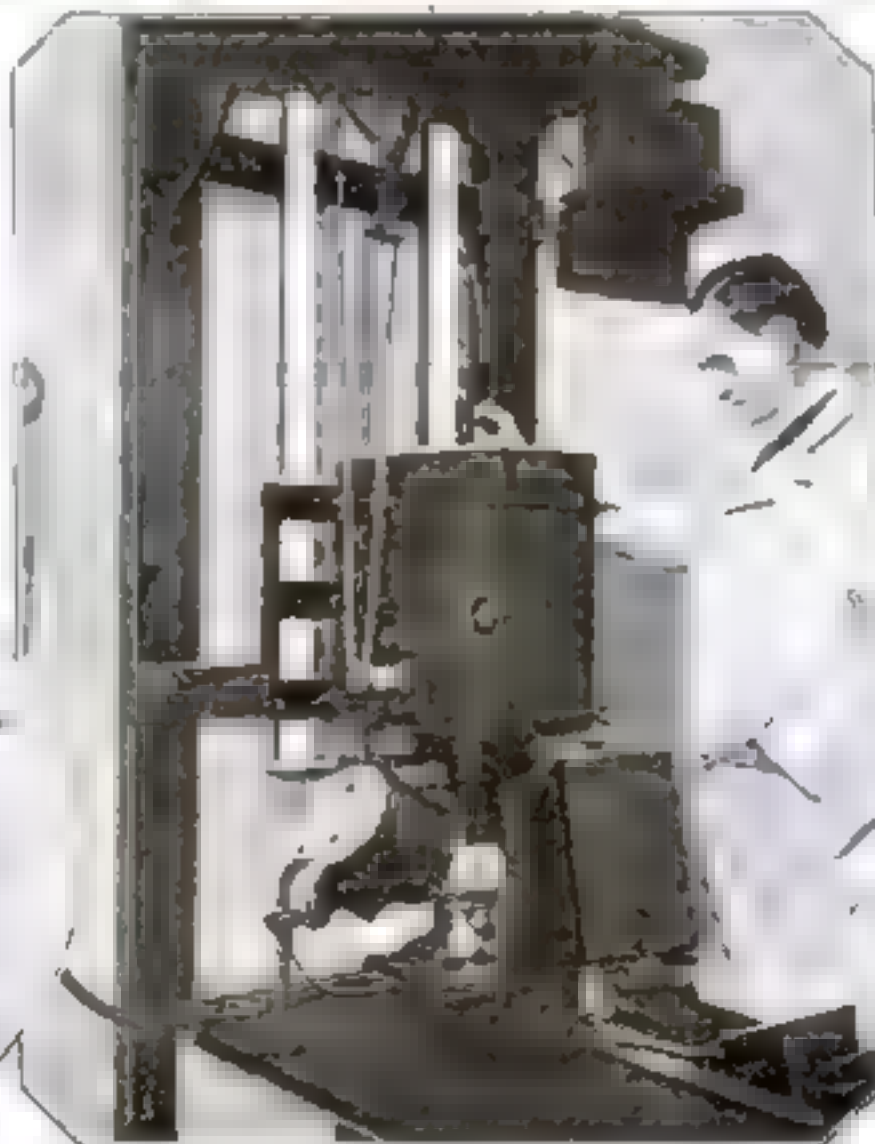
We can now watch the action of the living heart of an unborn chick. We can see the movements of millions of tiny blood corpuscles as they flow through the veins of a woman's arm. We can see the growth of a baby in the womb, beginning as each cell is faithfully recorded, enlarged and put together on a movie film.

Some wonders of the moving picture have been made possible by the

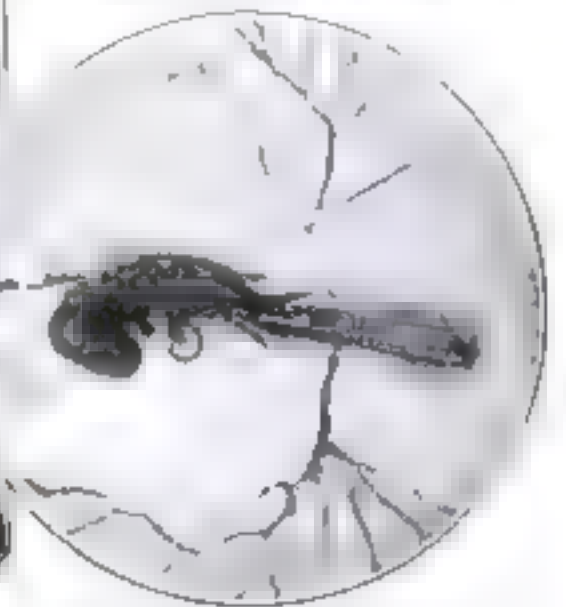
recent development of microscopic movies, or microcinematography, which may revolutionize the study and teaching of biology.

The apparatus used for the making of microscopic films is a special rigid table and a vertical mechanism by which the camera can be lowered or raised automatically. A clockwork mechanism for movement of the film not only takes up the slack of the film but also keeps the film taut. The lights are turned on and off automatically before and after the exposure is made. This simplifies the development of a certain subject over a long period of time, and enables the researcher to watch the exposure without the intervention of human hands.

The camera is fitted with a correct focus tube through which the image on the film can be watched during exposure.



Blood particles swarm through the veins.



Chick embryo, only 48 hours old.

Cinema camera apparatus for microscopic movies.

Three-Inch Apartment Walls Keep Out Noise

CONSTRUCTING partition walls only three inches thick for apartment houses so that they are soundproof and fireproof even though extremely light, is a problem that has been solved in the building of one of New York's most modern apartments, by the use of eel grass quilt hung behind vertical wires that are strung from ceilings to floors.

The quilt is a felted matting of cured eel grass inserted between two layers of exceedingly tough paper or asbestos—and stitched with strong thread. It is said to be proof from decay, fire and vermin.

Plaster Boards Help Kill Sound

The wires serve, not only to support the quilt, but also to deaden sound by absorbing vibration. Their arrangement is such that, after they are pulled taut, the eel grass quilt can be fastened between sets of the wires. Gypsum plaster boards, which also serve to deaden sound, are then placed on each side of the quilt and fastened to the wires with clips. Over the board, a final plaster coat is applied on each side to finish the wall.

Eel grass grows in salt water and contains considerable silicon in place of the carbon found in plants that grow in the air. This makes the grass practically fireproof, protects it from rats and other vermin, and preserves it from decay. Specimens of the grass are known to have been preserved in the air for 280 years.

Constant Noise Is Injurious

The problem of making buildings comparatively soundproof has been a subject of extensive scientific investigation. It has been found that the nerves of our ears are partially paralyzed by the fatigue effect produced by noisy surroundings, and that if the noise is continued over a period of years, the fatigue extends through the entire body. This, of course, is one of the reasons that people in general demand quiet rooms in their apartments during their rest hours.

Elaborate researches that were undertaken by the University of Illinois Engineering Experiment Station established the



Fastening eel grass quilt walls behind wires strung from ceiling to floor

fact that soundproof partitions must be as free as it is possible to make them from air passages, and that absorption of sound is the essential factor in soundproofing, since reflecting sound simply scatters it

and leaves it with energy. What really happens when sound is absorbed is that it is converted into heat energy by friction. The new eel grass walls possess this quality of sound absorption.

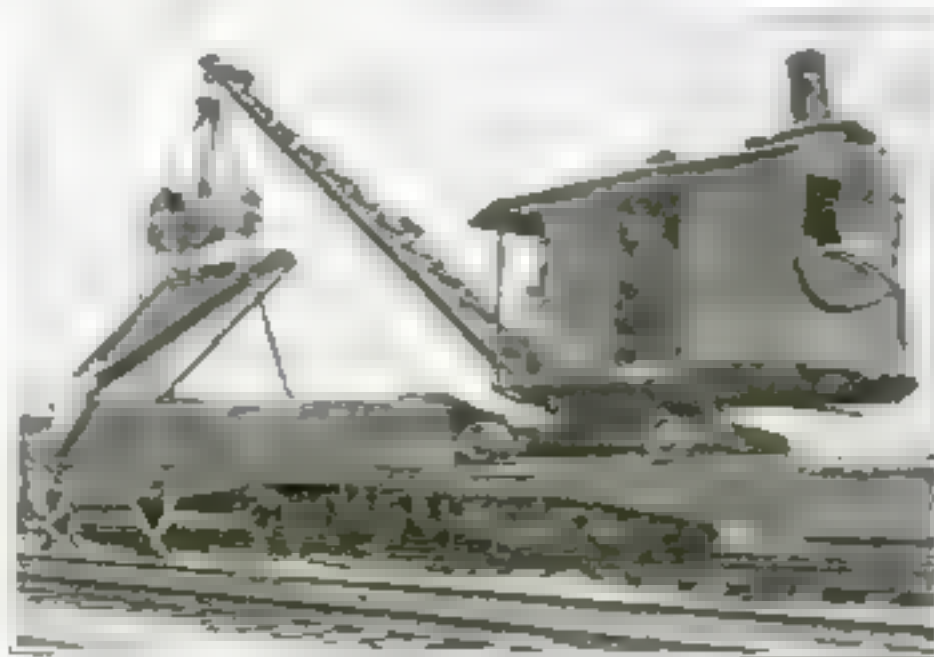
Clamshell Bucket and Screen Clean Ballast along Railway

THE cinders, dirt and other foreign matter that clogs rock ballast under railroad tracks and so retards drainage along the line is being successfully removed by means of an ingenious mechanical ballast cleaner operated by a large Eastern railroad. The outfit includes a clamshell dredge, mounted on a flatcar, that picks up the uncleared ballast from the roadbed, and pours it on a screen that sifts out the dirt and cinders.

The screen is placed at an angle over a gondola car in such a way that the clamshell bucket can discharge a load of old ballast near the top. As the material rolls down the incline, the dirt falls through the screen so that the remainder, which reaches the spout at the lower end, is made up of large clean stones only. Thus a load of

rock ballast is cleaned and immediately deposited on the spot from which it was originally removed.

The jaws of the clamshell are equipped with long teeth so that when the ballast is removed to a depth of only a foot, the subsoil is stirred up six inches below this level. This assists drainage greatly, since it provides a deep porous layer between rail lines.



The cleaner at work—screening dirt from ballast

About Inbreeding

THE general belief that the intermarriage of related individuals tends to produce low grade mentalities and inherent physical defects in offspring is contradicted by recent investigations carried on by the United States Department of Agriculture, Husbandry Division.

Inbreeding and cross breeding of guinea pigs showed that inbred families produced comparatively few abnormal individuals.

Motorized Fish Reel Leads Month's Novelties

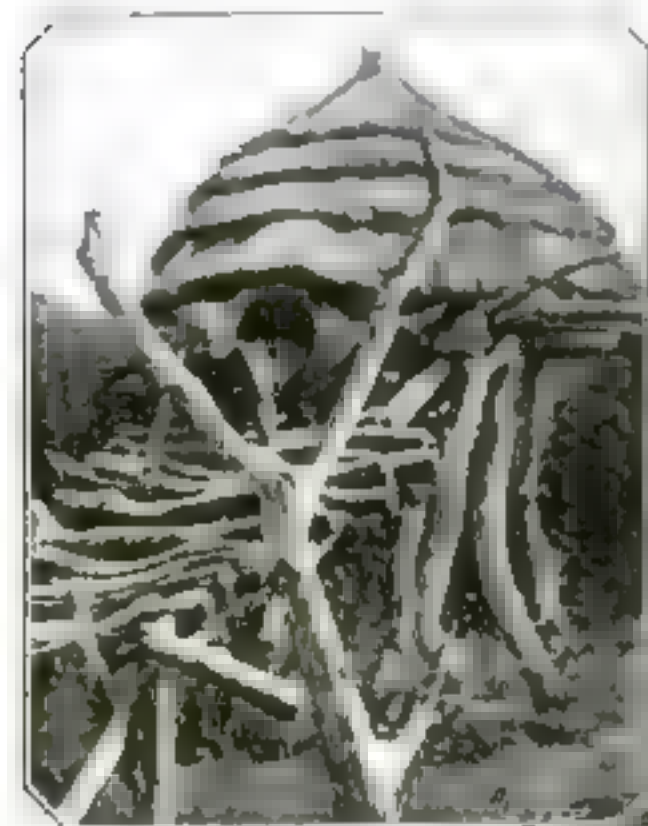


If you want to know how to catch a fish, you can't do it without a motor. The motor is the key to the fish.

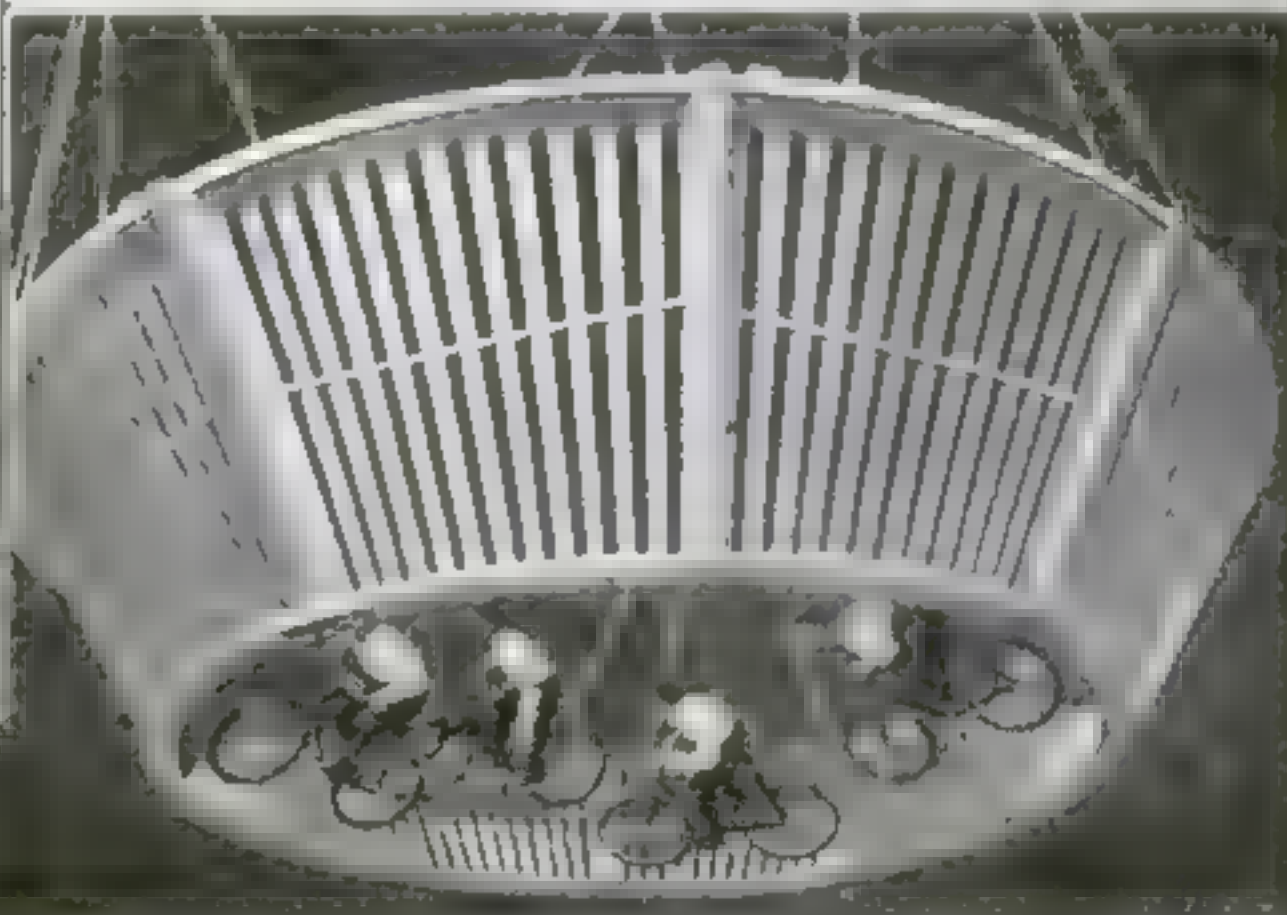
Chicago society girl, ought to fill the bill. When Florence gets a bite, all she does is turn a switch and, presto!—there's the fish. A small electric motor does the trick.



A massive domed tower 400 feet high—nearly as high as the Washington Monument—will form the bulk of the most unusual state Capitol in the United States, at Lincoln, Neb. Rising from the center of a square, two-story structure, the tower will house state offices. Light is provided for every room in the



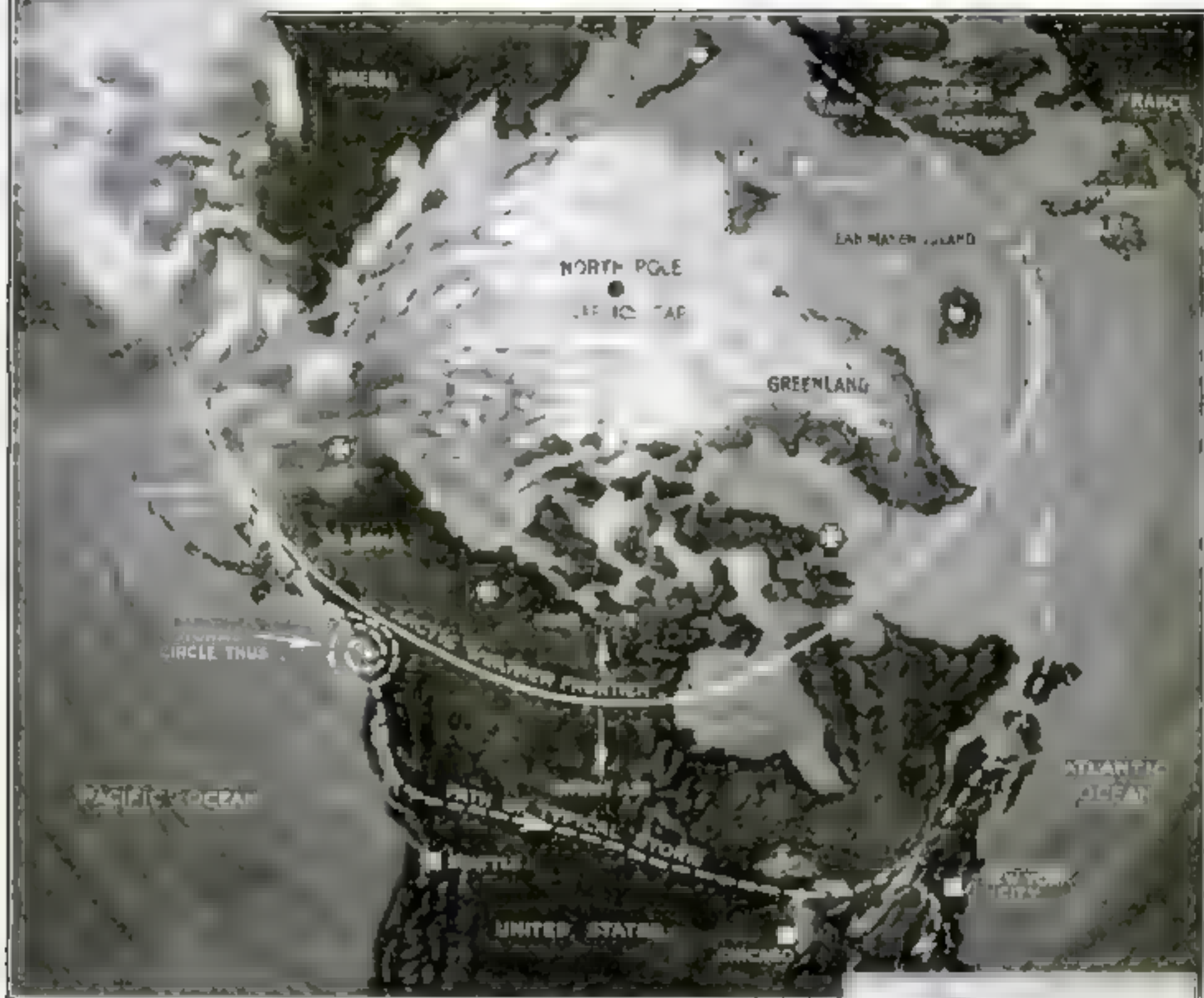
No coal shortages nor slow delivery service worry the family that lives in this port. The South African villa is built around and covered by a thick roof. An African boy is shown above crawling out of the doorway—a small porthole in the side.



Latest circus stunt—A bicycle race around the banked sides of a bottomless basket is thrilling German audiences. Centrifugal force holds the riders to the track as the basket is raised from the stage floor.

Photo courtesy Die Woche

Blizzard Warnings from the Arctic



This chart shows the breeding ground of many of our worst blizzards, which are born in the Behring Sea and may travel for 15 000 or 20 000 miles along the path indicated by the dotted line. The crosses indicate proposed arctic weather stations and the circles existing stations.

A CHAIN of arctic weather stations surrounding the North Pole, some of them on ships aloft in the polar seas and all of them in daily communication by radio with the rest of the world - this is the next advance in weather forecasting now being urged upon government officials in Washington.

Many of our worst storms are born unobserved on what is called the "arctic frontier," thousands of miles away from the populous regions which they later assail. To this icy zone weather stations exist in this frigid breeding ground of blizzards. It is on the remote island of Jan Mayen, off the eastern coast of Greenland. Here reports from this farthest weather station are the only accurate forecasts of the winter's worst storms will not be given until they are observed by other stations.

The cooperation of America in erecting such a string of stations is now being sought by Professor V. Bjerknes Ekero-

nd, a Norwegian meteorologist who is present at the Jan Mayen island station.

He explains the arctic frontier as a belt that follows the general line of the Arctic Circle around the world. Here cold air from over the ice caps meets the warmer air rising from the oceans to the south. When these masses of air of different temperatures and humidities come together great storms are formed that sweep for thousands of miles over great areas of the world.

I would be very glad

to see a station established on land for far north weather observation, he says, but in some cases the only way to get data is to be stationed at sea on a floating ship. A part of the arctic frontier, for example, may be that certain areas would be covered by specially designed cruising weather ships.

If the plan to establish this frontier guard is adopted, forecasters of all nations will have several days' warning of approaching storms.



Professor V. B. Ekero



The world's farthest North weather and wireless station, located on Jan Mayen Island see chart 400 miles northeast of Iceland. This station is expected to be the first in a chain that will encircle the arctic and give radio warnings of storms to weather observers of all nations several days in advance of the storms.

Sliding Celluloid Windows Convert Open Car into Sedan

CELLULOID windows that instantly convert an open touring car into a closed car have been installed in a new English all weather model that recently appeared on the market. When the automobile is used as an open car, the windows disappear into pockets in the doors and sides of the tonneau.

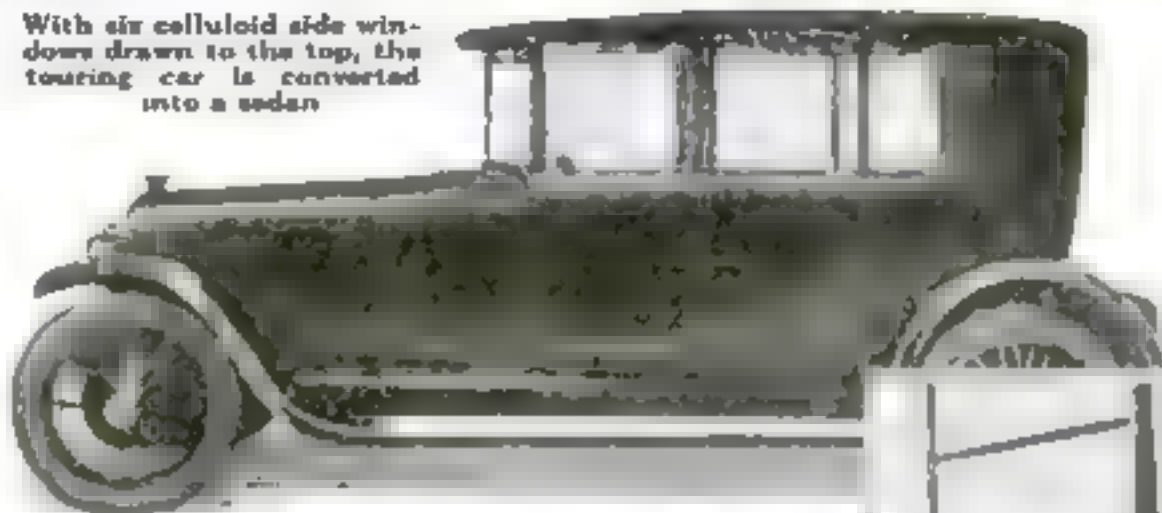
The celluloid window, which is made of very clear transparent material, is mounted on a frame that slides vertically in and out of the pocket. The frame runs on guide strips that swing up on hinges at each side of the pocket. When the window is lowered and the strips are swung down into the pocket, a small hinged door on the inside closes over the top of the pocket, completely hiding the contents.

Car Is Completely Inclosed

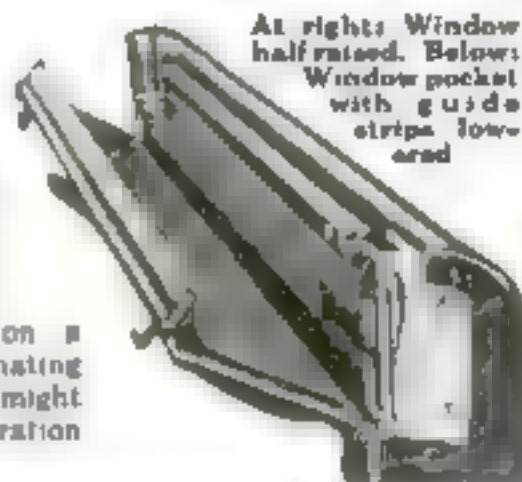
One of these window devices is provided in each door of the car and also on each side of the back seat, so that when the windows are raised and the hood is up, the car is completely inclosed.

The windows can be lifted to any position and can be used as side wind-screens without the top. The guides

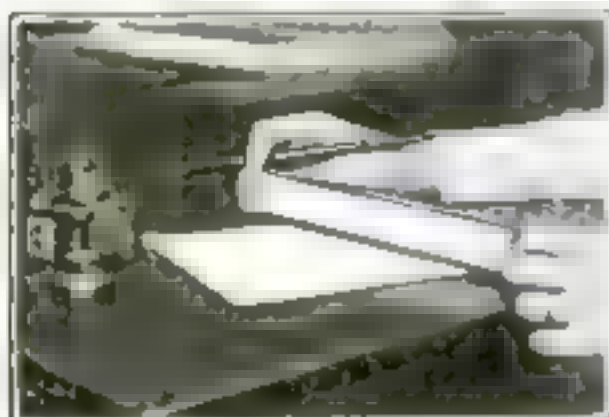
With six celluloid side windows drawn to the top, the touring car is converted into a sedan.



are slightly curved so as to permit the disappearance of the windows into the pockets. The doors are operated from the inside by pressure on a pedal, thus eliminating handle catches that might interfere with the operation of the window.



At right: Window half raised. Below: Window pocket with guide strips lowered.



Ruler Serves as Blotter

MOUNTED on the reverse side of an ingenious desk ruler are nine strips of blotting paper just wide enough for a signature. The blotters are fastened by clips.

Colors Fused into Glass by New Process

STAINED glass windows that usually cost many thousands of dollars can be made cheaply, and labels of any color can be imprinted on glass bottles at a cost less than that of printing them on paper. It is claimed, as the result of a recent invention of a new method of glass manufacture by Kalman Wurga of New York.

After studying and practicing glass production for many years in Bohemia, Austria, Turkey, and America, Wurga conceived the idea of applying the art of china painting to glass, with the result that he can print upon unannealed glass and burn the print into the glass during the annealing process in such a way that the most pleasing color combinations are permanently pro-

duced. The colors remain unimpaired even when the glass is subjected to heat sufficient to distort it.

The design is printed with specially prepared pigments on thin paper sheets. The



The glass bottle has been distorted by heat without injury to label.

Aircushion Rowboat Is Tied in Bundle

A COM-PACT and portable inflated rowboat has been made possible for the sportsman by Charles F. Smyth, of New Haven, Conn., who has devised a craft, soft as a pneumatic mattress, by attaching four inflated cylinders to a waterproof fabric bottom.

The four inflated cylinders, made of rubberized fabric, are connected, but inflated singly.



The complete rowboat inflated.

Rolled in a bundle.

paper is then glued upon the glass in its proper position. The glassware is next placed on continuous belts, which carry it a distance of from 75 to 90 feet through an annealing furnace. During the journey the temperature in the furnace is gradually raised to a maximum and then lowered. The high temperature reached is sufficient to consume the paper and the glue, while causing the printing pigments to fuse with the glass.

The print is thus integral with the glass and is as enduring as the glass itself.

It is easy to appreciate that this invention will be popular with manufacturers of trade-marked bottles, etc.

Models of Typical American Used by Auto Designer

How Cars Are Made to Fit Average Driver



Above, E. W. Goodwin, demonstrating use of manikin in auto design

SMALL celluloid manikins, representing exactly the physique of the average American, are now being ingeniously used by automobile designers to ensure for driver and passengers the maximum comfort and convenience in each new model they turn out.

Use of the manikins was originated by E. W. Goodwin, body designer for one of the largest automobile manufacturers. In order that these celluloid models should have a typical American figure, Goodwin constructed them according to the average proportions determined from measure-



ments of 100,000 American soldiers. They are so jointed as to conform to any normal position of the motorist.

As each new model is being developed on

At left, manikin illustrating correct driving posture for ease and safety

the drafting board, the manikins—made to the same scale—are frequently placed upon it to check the various dimensions affecting riding or driving comfort. There are innumerable points at which such a check is necessary—the height of seat and cushions, for instance, or the slope and height of seat back, location of steering wheel, distance to pedals and levers, line of vision through windshield, distance from floor to top, etc.

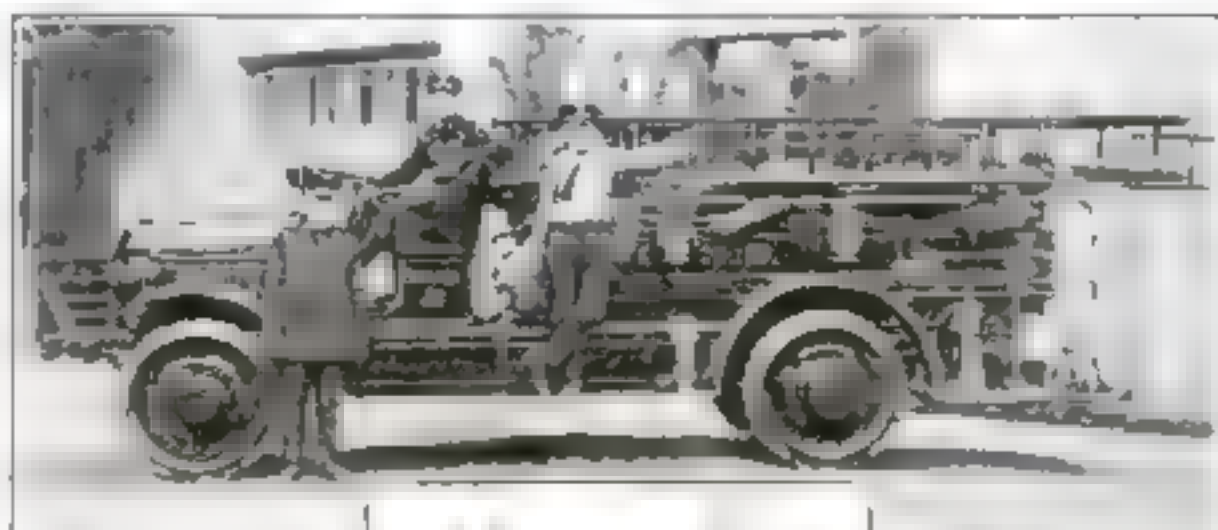
Goodwin also uses his manikins to illustrate correct driving posture. This erect position, as shown in inset drawing, should be conformed to for safety and comfort.

Novel Shockproof Wheels Lengthen Life of Motor Truck

MUCH of the road jar that tears at the chassis of the average motor truck, shortening the life of the car, is said to have been eliminated by a new and unusual shockproof wheel mounted on two flexible cone hubs. The use of the wheels, it is claimed, will greatly increase tire mileage.

The mounting is based on the principle of the cone clutch with 45-degree faces. The male cone, or hub, is rigidly mounted on the axle hub, while the female member is attached to the wheel. These two are kept in contact and centered by a heavy steel spring, which forces the male member outward against the wheel cone.

When a bump is encountered and the wheel is suddenly shot upward, the inner or axle cone slides out of contact with the wheel cone and is forced against the action of the spring. Thus the spring acts as a cushion and later will restore the cones to the cen-



For added speed, this fire truck is equipped with shockproof wheels



Diagram at the left shows wheel mounting and operation of hubs

tral contact position.

Further, when power is applied to the inner hub, this force is transmitted to the wheel through the spring, and the result is a gradual application of power to the wheel rather than a jerk. When the truck is finally moving, the spring restores itself to its original shape and the friction of the cones on each other serves to transmit the tractive effort.

A high tire mileage is obtained, since the only unsprung weight is that of the wheel

and the tire. All other weights are cushioned by springs that serve to take up the sudden loads that wear out tires.

It is claimed that the new method of wheel mounting will more than double tire mileage, at the same time increasing the maximum speed of the truck.

The new shockproof wheel is especially adapted for use on fire trucks, where high speed combined with easy riding qualities is desired.

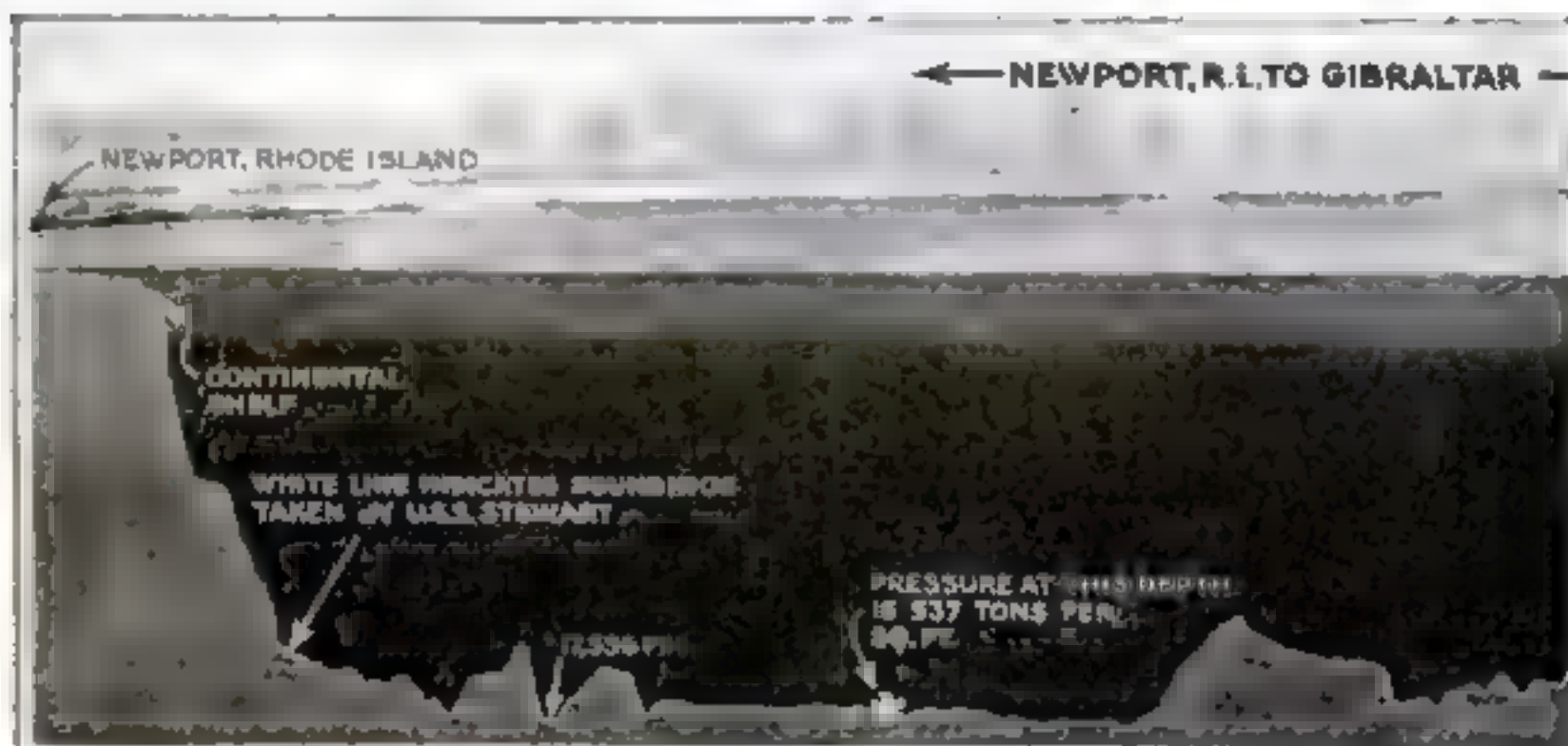
Sound Waves Probe the Blackest Ocean Depths

5000 Fathoms

The greatest known ocean depth is nearly five miles deeper than the deepest mine

DEEPEST MINE
7000 FT.

GREATEST KNOWN OCEAN DEPTH
32,088 FT.



This remarkable profile map shows the mountains, ravines, plateaus, and plains of the Atlantic Ocean bed from

SCIENCE, by measuring the speed of sound waves in water, is wresting from Davy Jones all the secrets of his locker—the mysteries of uncharted ocean valleys, submerged volcanoes and mountains, abysmal caverns and hills. With one gesture mankind is able at last to penetrate "bottomless" holes and to replace age-old guess and tradition with a faithfully accurate map of the bottom of the sea.

For centuries man has sought to learn exactly the precise form taken by the bed of the ocean; to find out—for example—what became of the lost continent, Atlantis, to know more of "Nero's hole," that cavern of the Pacific that sailors have declared has no bottom, to be able to tell accurately how deep the ocean is at any given point, in short, to know without any question what a raised map of the ocean drained dry, would look like. For centuries sea explorers were baffled. At tremendous expense, an enormous output of energy and time, they made many thousands of soundings by the simple expedient of dropping a lead attached to a cable. This, of course, was so difficult, so inefficient, that comparatively little was found out concerning the contour of the ocean's bed.

War came, and the submarine. Nations found it necessary to detect the approach of a submarine even though it might be fathoms below the ocean surface. The submarine detector resulted—a device that not only detected sound waves traveling through the water, but determined approximately the distance they had traveled. And, out of the war, came a remarkable new peacetime sounding device—the sonic

depth finder—which, according to the inventor, Harvey C. Hayes, physicist, of the United States Naval Engineering Department, will in four minutes make a far more accurate sounding of an ocean depth than has been possible heretofore in three hours.

The sonic depth finder is an ingenious apparatus that determines depth by the speed of sound in water. A sound impulse is sent out from a steel disk placed in the bottom of a vessel. This sound wave is echoed back from the ocean's bottom. By timing the journey of the wave and its echo, the depth can be exactly determined. Thus by taking many such soundings a vessel crossing the sea can determine and chart the depth of the ocean across its

fathom (a six feet) were taken with the sonic depth finder by measuring the time required for sound signals to travel to the bottom of the sea and return. About 800 soundings in all were taken, for depths varying between nine and 8200 fathoms. This was an average of about 100 soundings a day.

This expedition for charting the bottom of the sea revealed that directly off the Atlantic coast from Newport, the ocean bed dips practically straight down to a depth of 2750 fathoms, or 10,000 feet. At that depth it undulates like a great plateau until the vicinity of the Azores is reached. There huge undersea mountains, lifting their peaks above the level of the ocean, form the islands of the Azores.

Three mountain ranges may, at one time, have formed the lost continent Atlantis. From the Azores the ocean bed then dips down to the lowest depth reached on the trip, 8200 feet, rising again to form the European continent and Gibraltar.

The success of the destroyer "Stewart's" expedition in discovering fascinating new secrets of the ocean depths led to still further achievements.

Two more United States destroyers, the "Hul" and "Corry,"

are now engaged in the thrilling task of charting the Pacific, just as the Atlantic has been charted.

Already, with the aid of the sonic depth finder, they have discovered an uncharted mountain range 100 miles off the Pacific Coast, southwest of San Diego, Calif. One peak of this range is more than 1600 feet high. Another important "find" was proof that the floor of the Pacific Ocean off the California Coast had not been disturbed in recent years by volcanoes or earthquakes as was popularly believed.

When the Pacific has given up its hidden mysteries, other seas will be charted, until



United States destroyer "Stewart" mapping mountains and valleys of the Atlantic Ocean floor in its dash from Newport, R. I., to Gibraltar

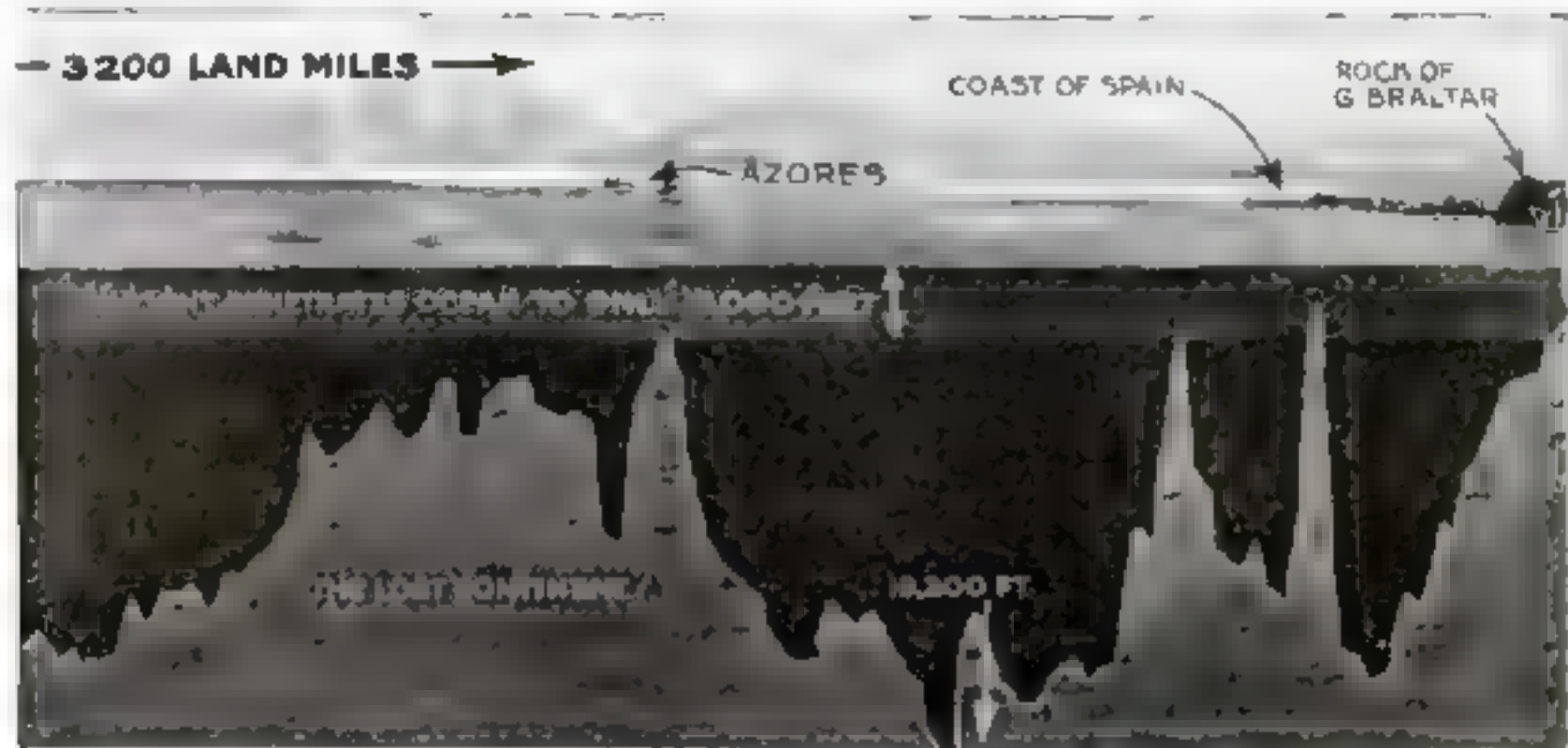
entire journey. In fact, naval experts say that ship captains will be able to steer their entire course across the oceans by means of these soundings, feeling their way along the bottom of the sea.

Convinced of the value of Hayes' invention, the Navy Department equipped the United States destroyer "Stewart" with a sonic depth finder and a trial trip was made from the harbor of Newport, R. I., to Gibraltar. There is a note of triumph in the report of that journey.

"The apparatus worked perfectly throughout the trip," says the report. "Depths greater than 90 fathoms (a

Under the Sea

How U. S. Destroyers Chart Atlantic Floor



Newport, R. I., to Gibraltar, as accurately charted by U. S. destroyer "Stewart," using sound waves to measure depth

at last we shall know accurately the contour of the entire bottom of the sea—71 per cent of the world's surface, or about 141 million square miles.

Curiously enough, although we have never been able to penetrate the farthest depths of the ocean, we know a great deal concerning them. We know, for instance, that the average depth of the sea is about 2½ miles, and that only 10 per cent of the ocean floor lies at a depth between the shore line and 6000 feet. We know that the deepest holes probably are in the Pacific—the "Swire deep" of 32,088 feet, or about six miles, off Mindanao Island in the Philippines, and the "Challenger deep" of approximately the same depth.

Heat rays are lost at about 250 fathoms, and even in the tropics the upper stratum of warmish water is comparatively thin. The great bulk of the water in the oceans is relatively cold. At depths of 300 feet it is probable that the temperature does not change as much as two degrees at any place and that below 600 feet there is no temperature change. It has been esti-

imated that 87 per cent of the entire amount of water in the ocean has a temperature below 40° F., and in the great depths it is undoubtedly just a little above the freezing point.

An idea of the tremendous pressure at great depths may be gained from the fact that when a piece of wood is weighted and lowered to a great depth, then pulled up again, it will no longer float; that if a corked bottle not quite full of water is lowered, either the cork will be pushed into the bottle or the bottle will crack. Water-tight compartments in lowered bodies collapse after they reach great depths.

The Earth's Three Divisions

Scientists distinguish three great areas of the earth's surface—the continental area (that above the sea's surface); the continental slope, from the shallow shelf of the continents down to the bottom of the sea (including about one sixth of the total superficial area of the globe), and the abyssal area, a prodigious plane at the

depth of the sea, including about 100 million square miles.

In the shallower water, the nature of deposits on the floor of the ocean varies from place to place, according to the nature of the shore rocks. There are gravels, sands, muds, and masses of organic matter. But on the floor of the abysmal depths, there is an accumulation of fine grained ooze consisting very largely of the remains of minute organisms that have sunk from the surface.

Strangely enough, there is probably far more living matter in the sea than on the dry land of the world. The sea is abundant in weird fish, shellfish, sea grasses, strange luminous plants, organisms of every imaginable variety. Concerning these we still have much to learn. But in our knowledge of these living creatures we have progressed far in discovering the exact contour of the land in which they live.

The highest airplane altitude record is little higher than the ocean is deep

AIRPLANE ALTITUDE RECORD
34,308 FT.

Many Machine Tools Combined in Electric Hand Drill

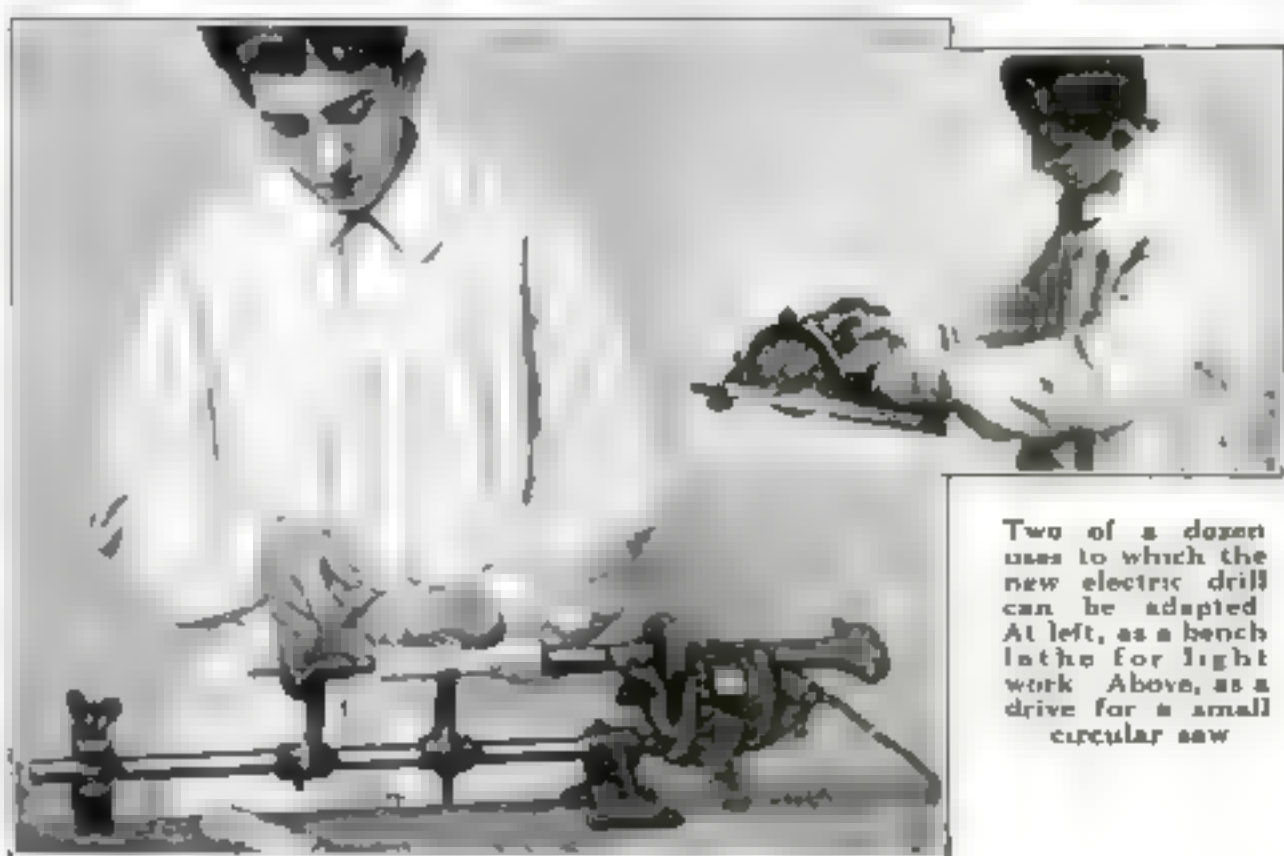
COMBINING more than a dozen machine tools in one, an electric hand drill of recent invention is adapted for a wide variety of light work in the small workshop, home, or farm. Its most valuable uses are as a turning lathe, a circular saw drive, and a grinding machine.

When it is to be used as a lathe, the drill is screwed to a bed fastened to the workbench, upon which is also screwed the tailstock and toolrest. For small wood work the improvised lathe is excellent.

When a Drill Is a Saw

For use as a saw, the drill is fastened to a guide and a small circular saw is screwed to the rotor. The guide is equipped with flanges that project over the sides of the wood to be sawed, and the drill is moved forward by hand. A blade follows in the saw cut to keep the saw in alignment.

The machine can be adapted to drive a milk separator, to cut turnips, clean corn, sort potatoes, and, when a grindstone replaces the saw blade, as a tool grinder.



Two of a dozen uses to which the new electric drill can be adapted. At left, as a bench lathe for light work. Above, as a drive for a small circular saw.

World's Queerest Animal Shown in Zoo

Furry Freak Said to Be
a Left-Over from
Dim Ages

Duck-Billed, Web-Footed
Mammal that Lays Eggs.
Comes 10,000 Miles

The only duck-billed platypus that ever lived in captivity outside Australia. Notice the bill and flat tail.



TRAVELING in an extraordinary "Pullman" cage built as an artificial replica of its home in the bank of the Namoi River, New South Wales, the strangest creature in the world—an Australian duck-billed platypus—recently was transported alive for 10,000 miles across the Pacific and the American continent to the New York Zoological Park. There it lived for 49 days amazing immense throngs by its peculiar appearance and habits.

The mysterious creature is described thus by a visitor from the Londoner: "I in a strange land of burrows and water holes. Like a duck, I saw a great wide flat bank stretching to a fuzzy line by a leathery cap. Like a duck too, it has webbed feet which it uses in swimming or wading on land. The feet are armed with long claws."

It lays eggs—lots of them. Yet strange to say, it suckles its young with milk. It lives in rivers, but sleeps in burrows in the banks. It feeds on angle worms, grubs and very small shrimps.

The body of the little creature is covered with heavy dark brown fur and is about 1½ feet long. Its broad, flat tail, heavily haired, is used as a sort of rudder in swimming.



Head Keeper John Toomey, of the New York Zoological Park, showing the furry little creature to New York children, after its 10,000-mile journey from Australia.

The ingenious 10-foot cage in which the platypus made its long journey had more compartments than a Pullman car. In the midship section was a large tank of water 18 inches deep, in which the animal swam round and round. On the forward "main deck" was an elevated pool that served as bathroom, flanked on each side by small sandbanks. The "quarter deck"

contained a labyrinth of narrow pathways connected by burrows fitted with rubber gaskets to scrape the water off the animal's body as it wriggled through. In one corner was a bedroom burrow, where the little fellow slept in a nest of dry hay.

Thousands of these extraordinary looking animals have been killed by fur hunters in Australia.

New Wing Flap Airplane Control Makes City Flying Safer

A NEW device to replace the "trailing edge" aileron, has been perfected by Grover Loening, airplane inventor and builder. He declares it will widen the scope of airplane usefulness by facilitating flying in the very heart of a city, and will prevent accidents due to "air pockets."

Heretofore lateral control of airplanes has been attained by mounting a movable surface or aileron at the rear or trailing edge of the wing—a system



Arrow shows hinged flap "pressure equalizer" substituted for trailing edge aileron.

that has proved unsatisfactory because it puts twisting stresses on the wing in such a way as to neutralize the aileron control.

Loening's device, known as a "pressure equalizer," consists of a flap hinged to the side of the wing behind an extension of the wing tip and controlled by the pilot. Since it is in front of the wing center, the pressure equalizer tends to lift one side of the wing, increasing the angle of incidence and simplifying the control.

To Broadcast Baseball by Radio Movies

Action Photos of World Events to Be Flashed on Distant Screens

MOTION pictures of world events broadcasted by radio and thrown simultaneously on screens in all parts of the world immediately after they happen!

This is the prediction of C. Francis Jenkins, a successful Washington, D. C. inventor. Jenkins has perfected an apparatus that transmits photographs by wireless for a distance of several miles and he plans to improve his machine so that movies may be sent by radio at the rate of 16 a second.

When this astonishing achievement is accomplished, it will be possible to "shoot" movies of a baseball game into the ether as it is played, by transforming photographic impressions into radio waves, then to pick up these radio waves in far distant cities and transform them back again into pictures that can be flashed upon the screen.

Turning Photos into Radio Waves

Jenkins' method of transforming a photographic impression into a radio wave impression is based on the principle that the intensity of light falling on a material known as selenium determines the electrical conductivity of that material, or in other words, its resistance to electrical current. Light, after passing through a negative and a lens, strikes the overlapping portion of two rapidly rotating circular prisms. These prisms are ground in such a way that lights and shadows of the picture are sifted through them in a series of parallel lines very close together.

The emerging light, following these lines, is picked up by another lens in a selenium cell and is caused to fall upon the sensitive selenium that serves as the "eyes" for projecting vision great distances.

Light Control

Since the selenium cell lies in an electric circuit, light of a certain intensity falling upon it permits a definite amount of current to flow. The electric current varies with the intensity of the light.

This varying current affects the wireless sending circuit in the same way as do the fluctuations of sound waves.

The receiving is accomplished by reversing the process of sending.

With Jenkins' present apparatus, four minutes are required to send a single picture. This is due to the fact that he rotates two of the prisms at only 400 revolutions a minute. By increasing this speed to 1600 revolutions, only one minute would be required; and when he is able finally to overcome the mechanical difficulties

involved, he hopes to reach the average movie speed of 16 pictures a second.

When this is accomplished, it will be necessary then to improve the machine further so that it will take photographs and transmit them without the use of negatives. The rays of light passing directly from the objects to the prisms will be sifted and impressed directly on the selenium cell.

Not only will it be possible to broadcast movies of news events in distant places, but also it will be possible for home radio

sets to pick up broadcasted motion pictures just as music is now received.

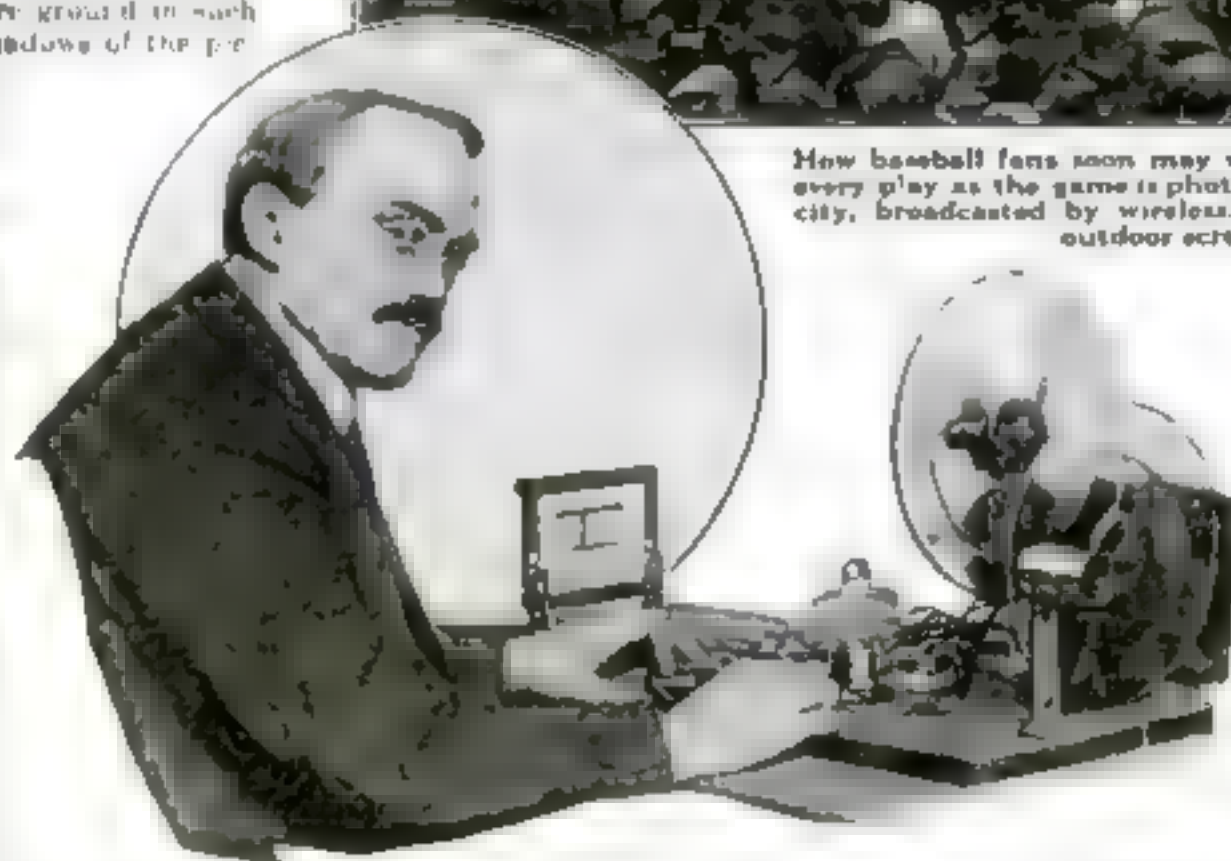
"But how can we see movies of a distant baseball game if they are thrown on an outdoor screen in broad daylight?" you ask.

One answer is found in the perfection of a daylight motion picture screen recently demonstrated successfully in New York City by Norman Furber. He says:

"The fact that the screen gives the best results even in bright daylight, provided the sun doesn't shine directly on its surface, is its most remarkable feature."



How baseball fans soon may watch every player in every play as the game is photographed in a distant city, broadcasted by wireless, and thrown on an outdoor screen.



C. Francis Jenkins experimenting with his apparatus for sending movies by radio. Notice the rotating circular prisms that sift the lights and shadows of photographs in such a way that they fall on a sensitive selenium "eye" and are transformed into wireless waves.

PEANUTS

How Scientist's 145 Varieties Helped Lowly "Goober" to Rise

AT LAST the lowly peanut has graduated from the circus tent. It has become, almost overnight, one of America's most important and most wholesome food products. It serves more than 100 needs of man.

This spectacular rise of the humble "goober" is due chiefly to the patient experiments of one man—George W. Carver, professor of agricultural science and husbandry at Tuskegee Institute. Professor Carver knows more about peanuts than any other man in the United States.

He took the friendless goober into his laboratory, cracked its shell, and probed deep into the secrets of its nutty meat. He found that it could be made into at least 145 different foods and useful articles. For example, Professor Carver found that one ordinary tumblerful of shelled peanuts will produce a pint of rich, creamy milk that you can drink in your coffee or pour over your morning cereal.

The Peanut's Progeny

Every one is familiar with peanut butter, but did you know that, besides 10 varieties of milk, peanuts can be made into:

Five kinds of breakfast foods, two grades of flour, ice cream in all flavors, cake, candy, salad oil, five kinds of punches, bisque, "Worcestershire" sauce, chili sauce, oleomargarin, and cheese—not to mention four kinds of meal stock for cattle feeding?

Did you know, too, that peanuts can be made into many useful commercial articles, such as nine varieties of wood stains, leather dyes in 19 shades, metal polishes, axle grease, toilet and laundry soaps, ink, tannic acid, and glycerin?

All these uses Carver developed—and he is still at work. Even now he is perfecting several peanut medicines, and he is making quinine from the red outside skins of the nut. Peanuts are one of our most wholesome, nourishing, healthful appetizing foods, he says.

Steak as the Goober

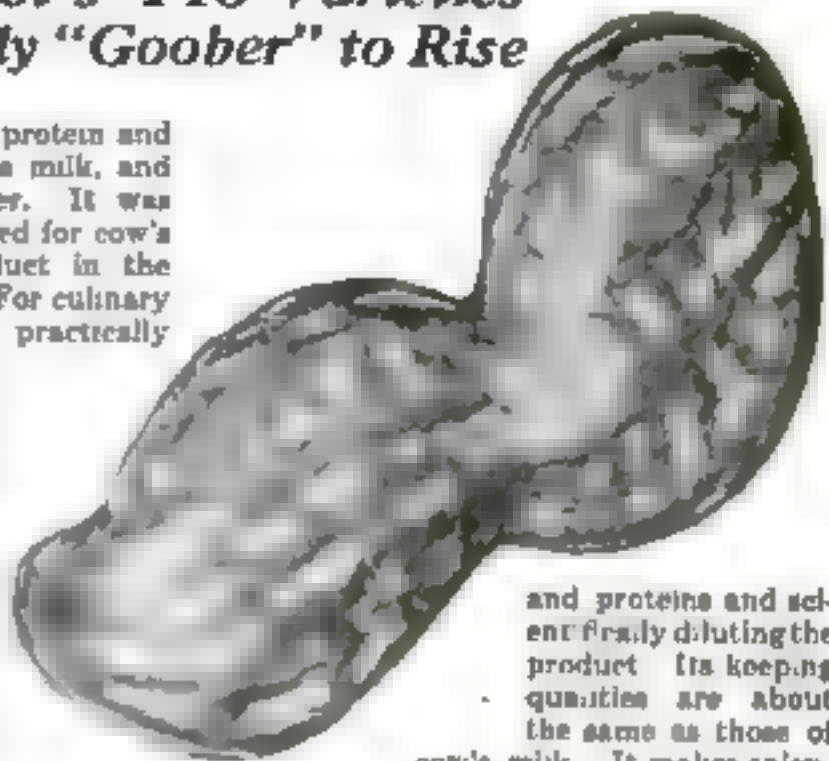
"A pound of peanuts contains a little more of body building nutriment than a pound of sirloin steak, and nearly twice as much heat and energy producing nutriment," said Professor Carver. "Peanut oils are palatable and supply the body with heat, fat and energy. The peanut contains proteins in abundance, as well as the much prized legumin, lysin, myosin, and amino acids."

Concerning peanut milk, he explains:

"It is rich, creamy, and palatable, and it contains three times as much carbo-

hydrates, three times as much protein and 12 times as much fat as cow's milk, and only one tenth as much water. It was never intended to be substituted for cow's milk. It is a distinct product in the dietary of the human family. For culinary purposes its possibilities are practically unlimited. The sweet and the sour milk both can be used in the same ways as cow's milk, the curds can be made into many fancy types of cheese and fillers for pastry.

"Peanut milk is a perfect emulsion of the oils, fats, proteins, carbohydrates and some of the ash of the peanuts. Many different kinds of milk can be made by controlling the proportions of carbohydrates



and proteins and select freely diluting the product. Its keeping qualities are about the same as those of cow's milk. It makes splendid bread, rich in flavor, and is excellent for creaming vegetables. Since it is a purely vegetable drink, it forms body building nourishment for invalids or children."

Faced with Ruin

The event that started Carver on his efforts to help the peanut to fame was the disastrous invasion of the boll weevil into the cotton fields of Alabama. One day a wealthy woman farmer, owner of many acres, came to him and said:

Mr. Carver, what are we farmers going to do for a money crop? The boll weevil is about to ruin us."

That started him thinking "How about the peanut?"

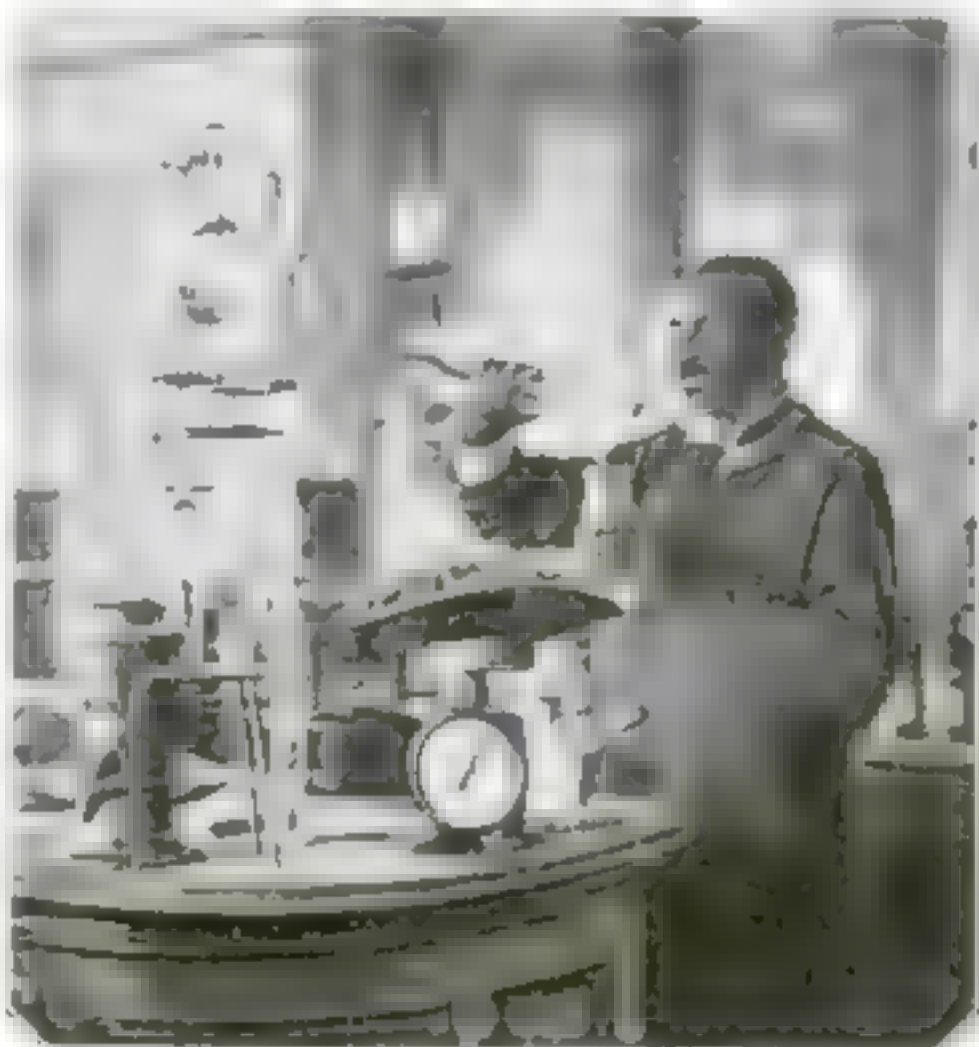
His laboratory experiments told him. They told him so clearly that their results have astonished the world, and have set men to planning great factories where the once neglected goober may be turned into foods.

And they have done more than that. They are returning a profitable money crop to thousands of acres of unprofitable farmland in the Southern states. They are beginning to save the South from the bondage of King Cotton.

Enriching the Soil

"The peanut crop is profitable because," Carver explains, "it has power to extract nitrogen from the air and deposit it in the soil, thus becoming a soil builder rather than a soil robber."

Today, this wizard of peanuts, George Washington Carver, rightfully may be called the Burbank of the South. By helping the ground pea on its way upward, he has added immeasurable wealth to the soil and has opened tremendous storehouses of new and nourishing foods for the world.



Prof. George Washington Carver in his laboratory, making peanut milk.

Do You Eat Your Half Bushel of Peanuts Each Year?

DID you know that last year every man, woman and child in the United States consumed on an average, more than half a bushel of peanuts in one form or another?

Twenty-five years ago the peanut was a "no account" in American agriculture. Today the annual production of peanuts in the United States—about 53,000,000 bushels—would fill a tank nearly two miles wide and $1\frac{1}{4}$ miles high.

The yearly production of peanut butter alone is more than 7,000,000 pounds, and of peanut oil more than 3,000,000 gallons. And these are only two of the 145 useful products developed from the goober, largely through the experiments of Professor Carver. Important results of his work are described in the accompanying article.

Iron Finger Discovers Sunken Treasure

How Falling Mass of Iron Located Rich Copper Cargo Buried in Mud "Somewhere in New York Bay"

AN ELECTRICAL needle that searches the sea's bottom for sunken metal, has been responsible for the salvaging of a million pounds of copper valued at \$150,000, from the bottom of New York Harbor. Divers predict that the ingenious device, which is the invention of R. E. Chapman, a naval engineer, will reclaim millions of dollars in lost cargoes.

In January, 1920, the navy barge "Anode," loaded with copper bars, was rammed by the army transport "Buford." The barge tipped over, dropped its treasure into the bay and then floated away. There were few witnesses of the collision because of a dense fog, and therefore no one could give exact information of the location.

Harbor Is Charted

In undertaking to raise the metal bars, a New York wrecking company first learned that they lay somewhere in the main channel between Governor's and Bedloe's islands. This vast tract was then charted in seven-foot squares. Finally, a specially designed iron weight was dropped into the river bed at each corner of the squares thus formed. The method of making these soundings was as follows:

A car barge carrying a traveling derrick was pulled along the lines of the charted squares by hauling in on the forward anchor lines. Whenever the barge reached a corner, the ton weight, eight feet long and pointed at the nose, was dropped over the side, penetrating the mud bottom to a depth of 10 feet. To the weight was attached a cable from the derrick above.

The Ammeter Reports Success

An electric current was then run through the iron mass and through electric wires paralleling the cable to a special ammeter on the barge. When mud or iron was struck by the pointed weight, the ammeter needle deflected in one direction; but it was known that if copper was struck, the ammeter would record it by an opposite deflection. After innumerable trials, the iron crashed down into the mud in which the copper bars were embedded, the needle showed that the search had been rewarded and the work of hauling up the metal was begun.

An orange-peel bucket was then sub-



Crashing through 10 feet of mud, the iron weight located sunken copper bars as shown at the right. Above: Washing mud from the copper hoisted in derrick bucket.

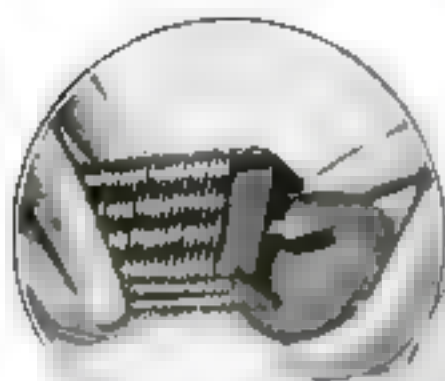
stituted for the iron weight. This bucket was lowered into the mud and when it was hauled back to the deck, it was found to contain several bars, which were identified by certain numbers that each bore, as part of the "Anode's" lost treasure.

As the salvaging progresses, the ingots, after they are hoisted in the bucket, are washed off at the depot of the wrecking company. From there they are shipped by motor truck to the government warehouse.

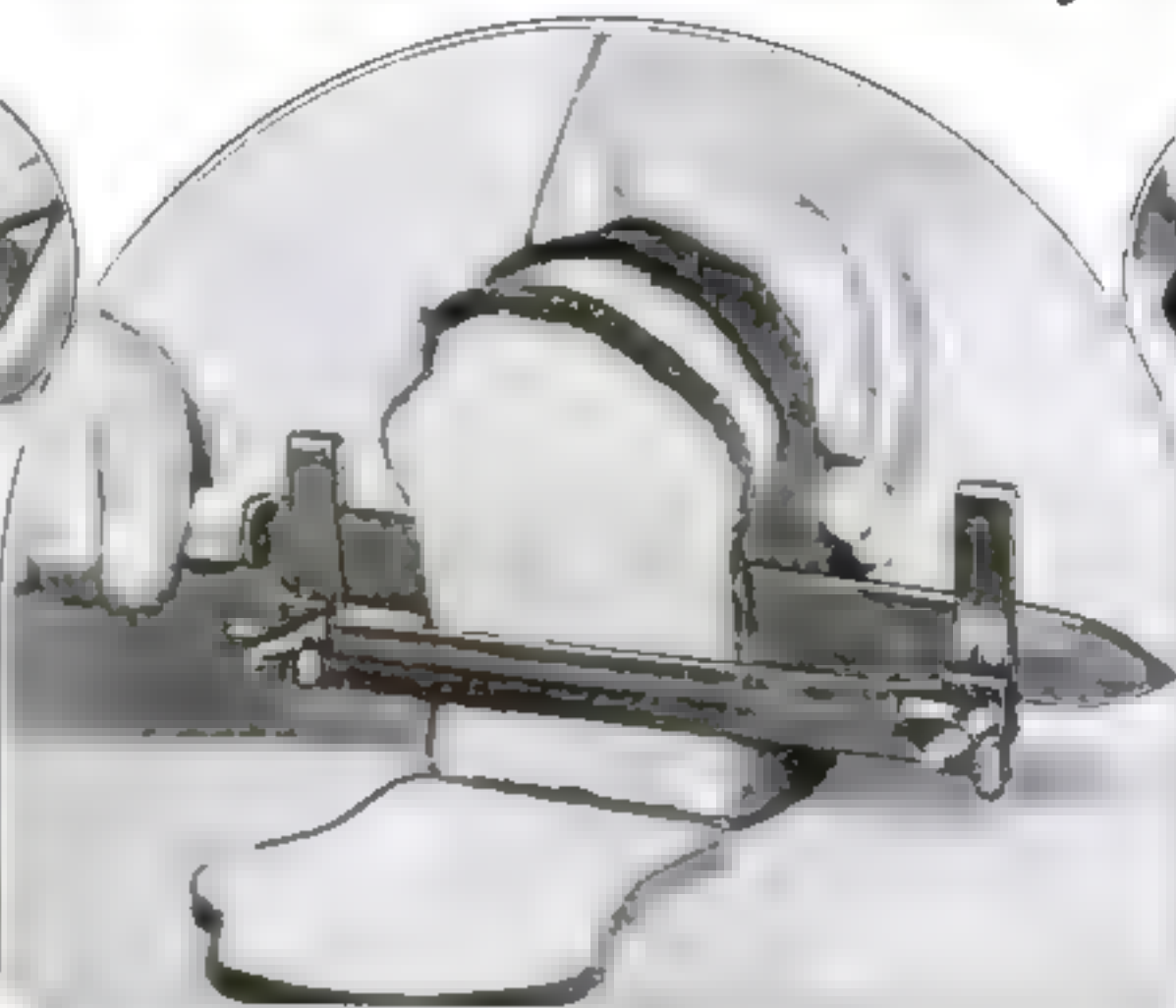
Naval officials expect that all the copper will be recovered.



Put the Kitchen on an Efficiency Basis



The potato scraper pictured above takes off the skin with the least possible waste. It is made of sharp wire stretched across a wooden frame.



Slices of bread can be cut exactly the same thickness by the use of the gage shown above, which fits any knife. The thickness of the slices can be adjusted by the wing nuts at the ends.



This little pot and pan cleaner protects the knuckles of the operator. The handle is at the center of a triangular scraper.



The above utility kitchen chair, with or without a back, combines with it a ladder and a shoe-shining outfit.



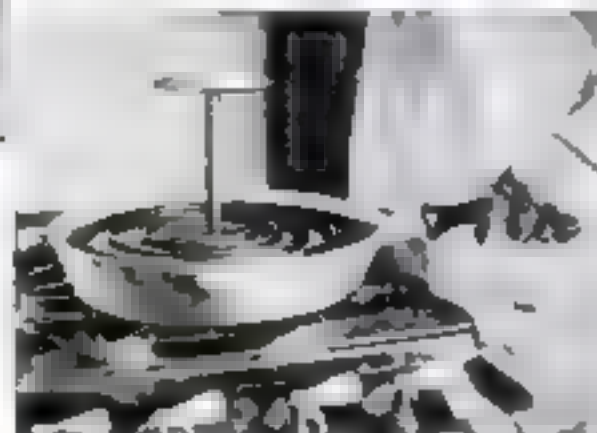
Draining boiling water from cooked vegetables has caused many a scalded hand, but by the use of this perforated boiler, the contents automatically drain themselves when lifted from the saucepan to the sink.



Why wasn't it thought of before? Here's a nail polisher that boasts an easily removable strip of chamote, which means an easily replaceable one. The "spare" come in sealed waxed paper packages.

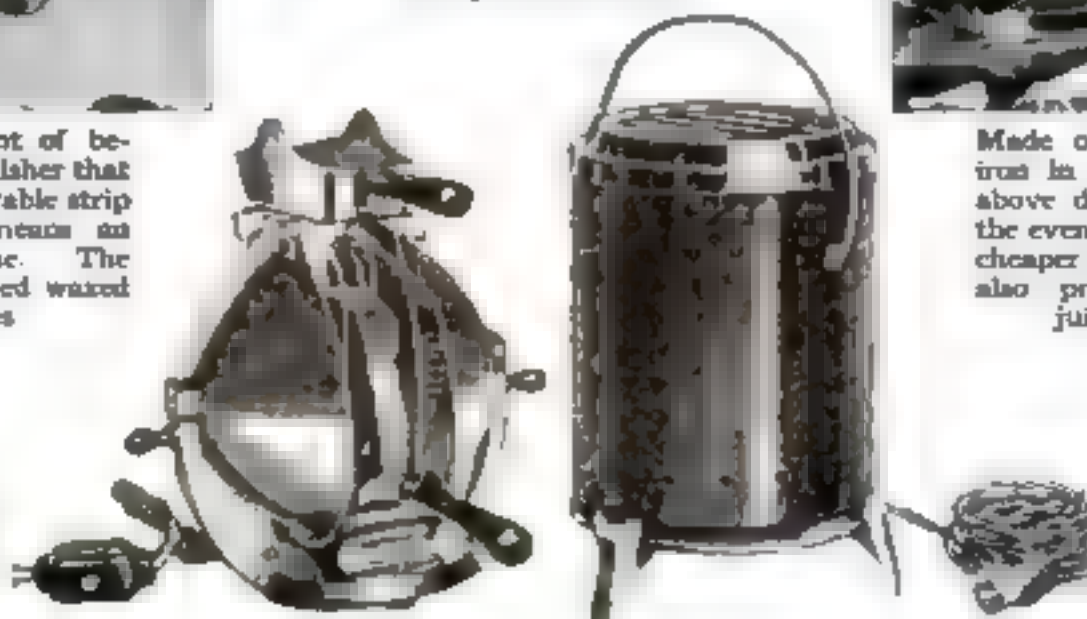


Where electricity is not installed, this small and light weight vacuum sweeper is pumped by hand to create a suction.



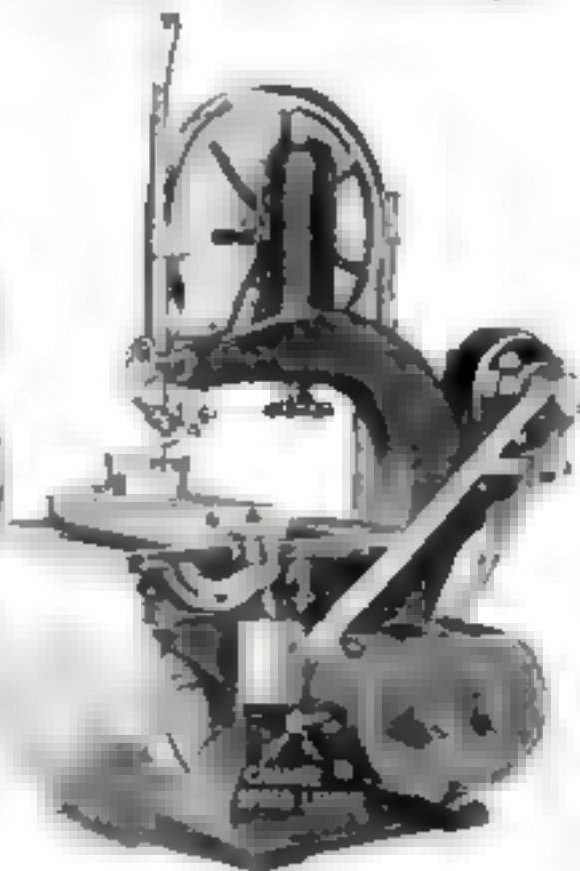
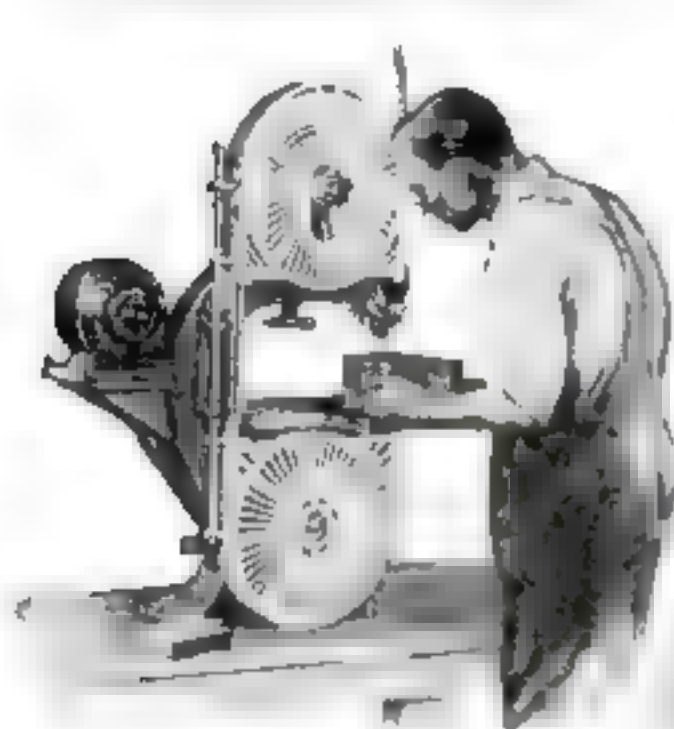
Made of flat three-eighth-inch iron in open scroll shape, the above device is said to assure the even and quick frying of the cheaper cuts of meat. The fryer also prevents the nutritious juices from escaping.

This electric toaster will toast both sides of a slice of bread at once, while frying eggs in the small pan above it.



It cooks while it heats. This neat looking heater will fry, boil, or toast food, thus saving space in cramped quarters.

Bandsaw Cuts Wood or Metal



Front and rear views of high speed wood and metal bandsaw. At right, gravity feed and speed lever

A PORTABLE bandsaw, designed to cut either wood or metal, is finding ready application in small plant repair shops, where its twofold service eliminates the necessity for separate machines.

The machine has a two-speed attachment—the slow speed for metal work, the high speed for wood. By means of a special saw guide, the usual wood and metal blades may be quickly inserted when changing from one type of work to the other. Special combination spring

temper blades are provided, however, and these will serve for both wood and metal work at high speed.

A gravity feed vice attachment that draws the work against the saw teeth, permits the cutting of bar stock, rounds, flats, and shapes up to three inches in thickness.

For materials that are to be cut at an angle, the work is clamped to the table, which can be tilted at any desired angle up to 45 degrees.

Each patient applying for treatment for rabies at the Pasteur Institute at Breslau University, Germany, must supply a whole, live rabbit for inoculation. No dead ones allowed. Two rabbits are preferred if patient can afford it.

Knock-Down Cart Is Boy Scouts' Table

BOY Scouts of Madison, Wis., have built an ingenious collapsible "trek cart" designed so that it can be used not only for carrying equipment on the hike, but for "furnishings" about the camp.

The body of the light, two-wheeled cart is a shallow box, the sides of which are removable and so constructed that they can be used as benches when removed. The bottom of the box serves as a table top when camp is made. It is equipped at each corner with a flange casting into

Here's a Way to Pull Weeds without Backache

TWO prongs attached to a long hardwood handle and connected by a crosspiece form the weed puller recently invented to take the kinks out of the gardener's back.

The sharp prongs are slipped under the roots of a weed and the handle is pulled upward. The roots are caught between the prongs and the crosspiece prevents them from slipping out as they are forced from the ground.



How the weed roots are caught between prongs and pulled



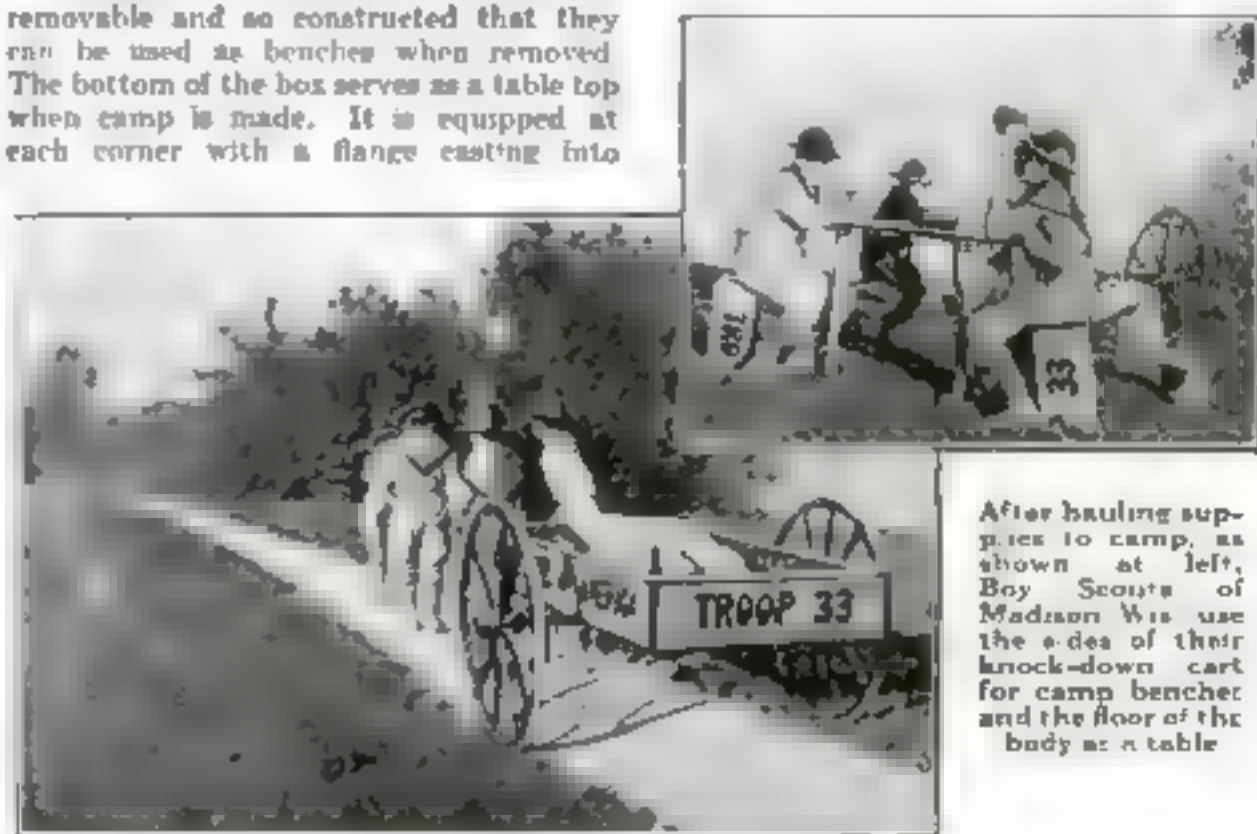
Tree Branches Crafted to Form Living Splice

TO PROTECT fruit trees from severe storms that often split branches and even completely uproot trees, investigators of the Ohio Agricultural College have succeeded in intertwining branches to form living splices and so support each other.

This method of grafting has been found to be exceedingly satisfactory, and it is claimed that branches actually coalesce and unite, causing them to appear as one limb with two points of origin.

which iron pipes may be screwed to form table legs.

When the scouts reach camp, the axle is unbolted from the box, the wheels and axle form a convenient carrier for firewood, while the body provides table and benches.



After hauling supplies to camp, as shown at left, Boy Scouts of Madison Wis. use the sides of their knock-down cart for camp benches and the floor of the body as a table



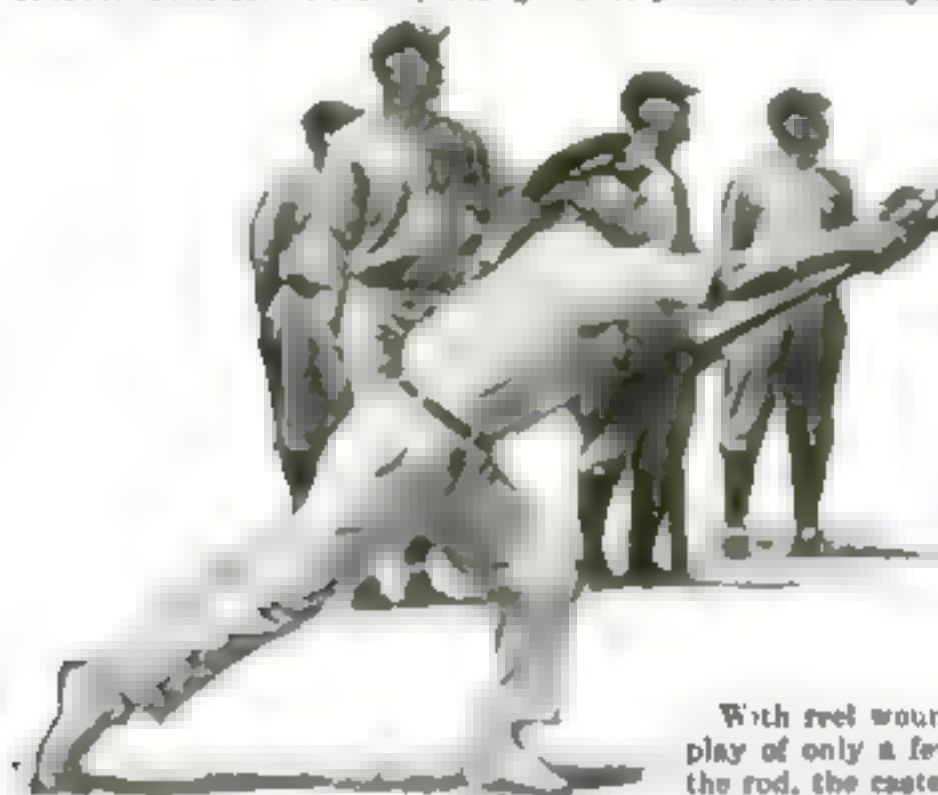
Champion Angler Casts Farther than Babe Ruth Can Hit a Ball

DID you ever try the sport of fishing on dry land, several miles away from any water or any fish?

If not, you've missed a sport enthusiasts say is the greatest thriller of the day and that medical authorities say is an ideal outdoor exercise. In fact, the game of

which to cast in surf fishing, these men seldom see the ocean.

An ordinary split bamboo rod with its usual reel attachments is used. Attached to the reel and rod is hundreds of feet of special 12 linen line, somewhat stronger than that usually used in surf fishing.



Casting a four-ounce lead sinker nearly 30 feet farther than Babe Ruth could hit a baseball, Harold G. Lentz, world champion "dry surf" fisherman, amassed 30,000 fans, as well as the home-run king himself, at a recent exhibition in the Polo Grounds, New York City.



Babe Ruth congratulating his conqueror

On the end of the line is a four-ounce pear-shaped lead.

With reel wound so that the lead has a play of only a few inches over the end of the rod, the caster manipulates the rod so that it extends behind him, over one shoulder, as far as possible. Bringing the rod up and forward with a terrific speed, using his forearm as a lever, he suddenly arrests its motion with a jerk. The attached lead carrying with it the line that unwinds from the reel, speeds through the air with the force of a shot from a gun. The object, of course, is to attain great distance. The distance of a cast—like that of the shot put or discus throw—is measured to the point where the lead first strikes the ground.

Tremendous distance casts are accomplished in this way. In 1910 W. J. Moran startled fishermen both of this country and England by casting for a distance of

314 feet. Year by year the record was increased until in 1920 Harold G. Lentz, the present champion, attained a distance of 465 feet. He also set another world's record by casting three times for an average of 434 feet 11 inches.

This feat aroused so much comment that an argument arose as to whether Lentz could cast a four ounce lead farther than Babe Ruth could hit a baseball. In an exhibition in New York Lentz outclassed Ruth in distance, surprising some 80,000 fans at the Polo Grounds and the home-run hitter himself.

The sport is now controlled by a national association known as the Association of Surf Angling Clubs and a \$2000 perpetual trophy is given by the Ocean City Surf Casting Club for the record tournament cast each year. Many women are becoming interested in the sport and some of them have attained records as high as from 235 to 250 feet.

fishing without fish bids fair to rival football, baseball, and basketball in popularity, largely because of its suitability to the needs of business men, the scientifically correct principles of exercise it involves, and the competitive thrill it encourages.

Twenty years ago America barely knew this sport, known as dry surf casting. Today it has thousands of devotees. Almost any afternoon or holiday in the year, you may see, in parks and fields around New York City, groups of men with their fishing rods diligently practicing for hours the art of casting. Although the sport was originally devised as a method of teaching novices the proper manner in

Where Do You Live? Your Energy Depends on the Climate

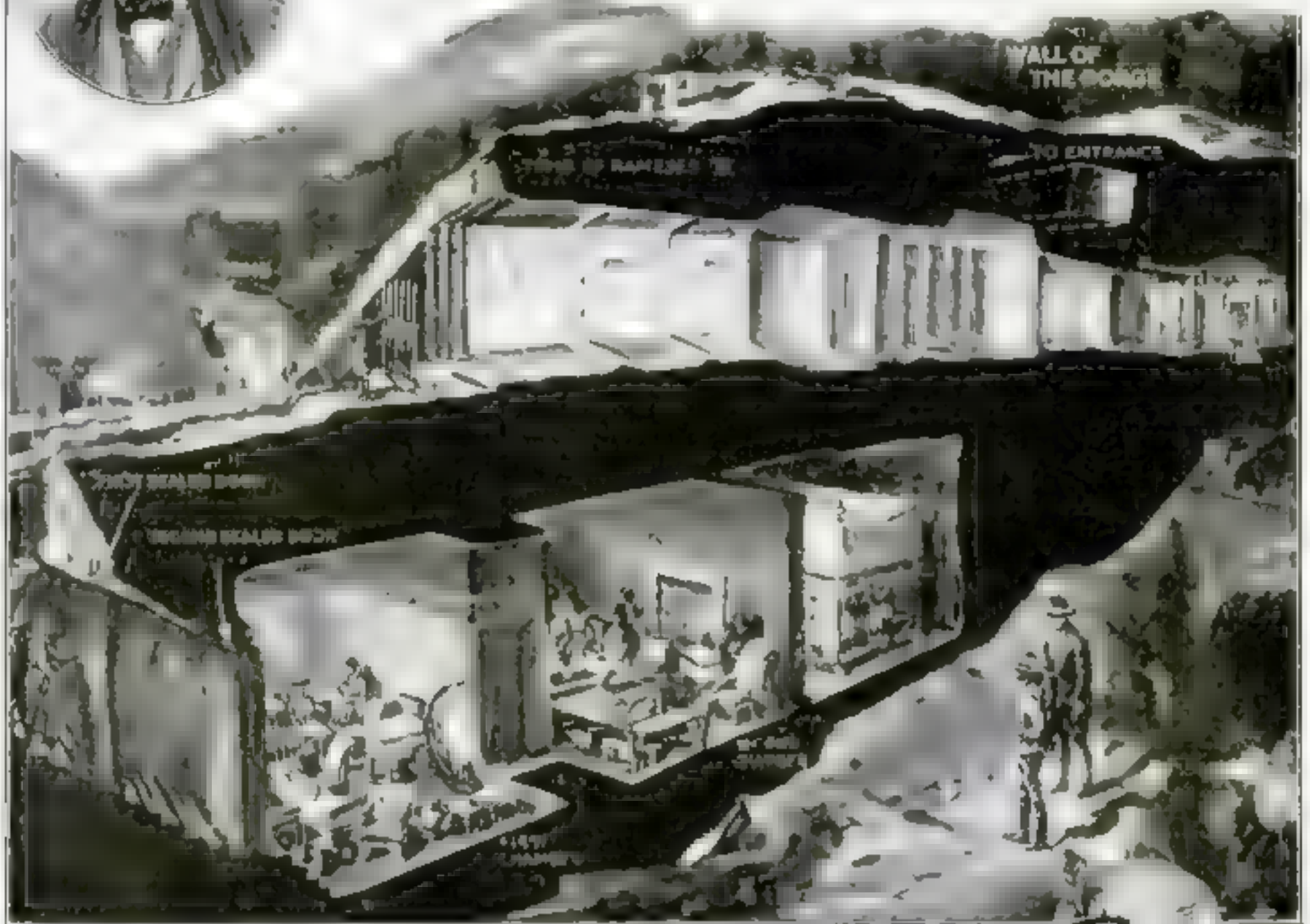


Courtesy John Wiley & Sons, Inc.

DO YOU live in an invigorating climate? This map of "human geography," based on recent scientific investigations, shows how our energy is affected by various climates, as indicated by the key at left. The highest human energy is found in black portions on the map—northeastern and north central United States, and northern Europe. South-

eastern England is said to have the world's most invigorating climate—frequent variations in temperature; cool but not cold winters; temperate summers and relatively high humidity. These are the conclusions of Elsworth Huntington and Sumner W. Cushing, in their new book, "Principles of Human Geography" (John W. Wiley & Sons, Inc.)

"Lost Pharaoh" Defies Scientists to Bring His Mummy to Light



How King Tutankhamen's tomb was bored into the hillside beneath the tomb of Ramses VI in the Valley of the Kings. Note the burial chamber beyond two outer treasure chambers. Howard Carter, American Egyptologist, who made the discovery is shown in inset.

HOW will scientists get a King Tutankhamen's tomb?

Will further knowledge of Egyptian history be gained by the discovery of the great Pharaoh who ruled Egypt more than 3,000 years ago—3,000 years before Solomon?

The world, filled with curiosity and longing for the riches treasure hunters' history has not had a suspense for an answer for the last of a powerful Pharaoh to give up his wealth from the secret royal vaults and in the famous Valley of the Kings. How defies the world to bring him to light?

For 53 years Howard Carter, noted American Egyptologist, has been the master of the Valley of the Kings, searching for King Tutankhamen's tomb. At last, he found it. Buried in the tomb, and sealed at the foot of a narrow hallway, was beneath the tomb of Ramses VI. Two outer chambers gave up amazing treasures of the dynast. Then, passing a second chamber at the far end of the passage, and passing between two statues of the ancient king that had stood as sentries for 3,000 centuries, they came to the supposed royal burial vault.

Standing at the threshold of the supreme discovery, peering through a hole in the

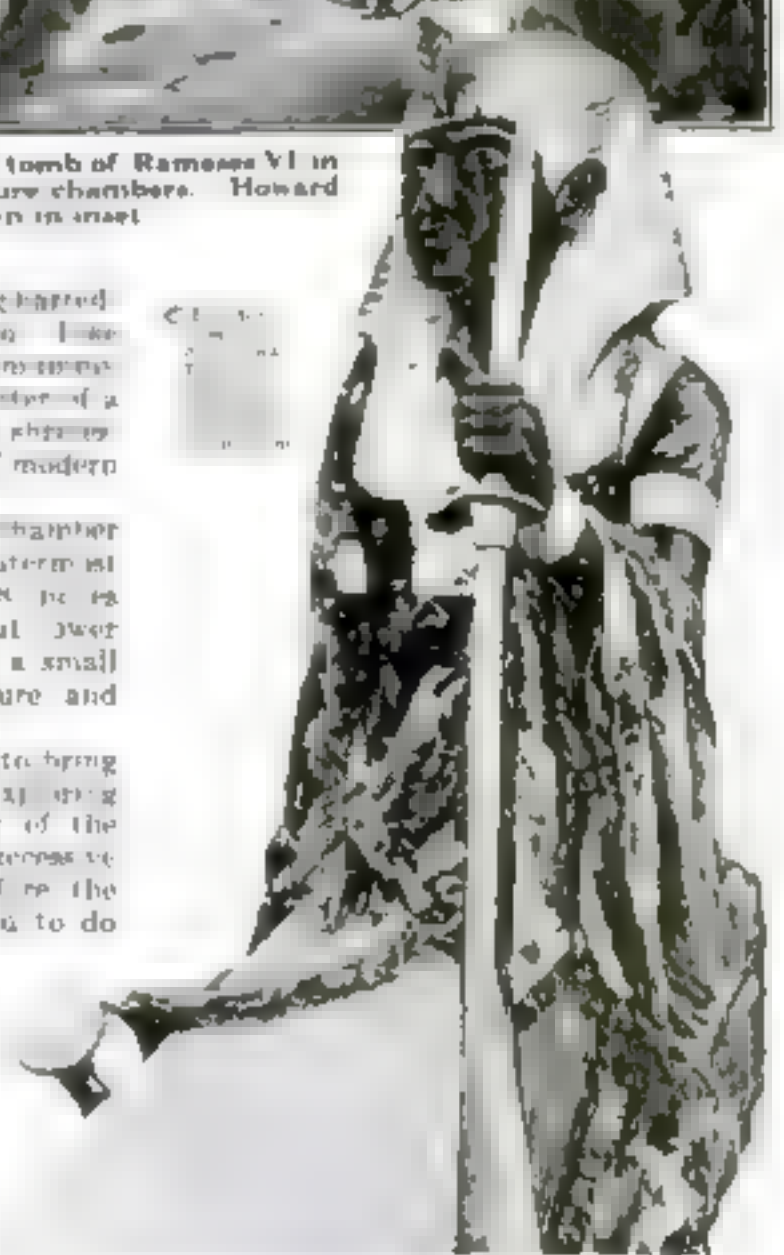
wall, they found the way to the king's tomb.

King Tutankhamen is buried in a tomb about a yard above his last army captain's to his own, by a higher level of a series of walled and arched chambers. And the task of the ingenuity of modern science to reach him.

Between the wall of the burial chamber and the wooden screen of the outermost stone, the passageway is only 18 inches wide. At one side and somewhat over than the main burial chamber is a small urnet, packed with added treasure and reached by a side opening.

To reach the king's mummy or to bring out the new treasures, the exploring scientists must reverse the order of the barriers. First, the shell of each successive chamber must be removed before the next one with a high explosion, and to do this the outer wall of the burial chamber must be demolished. But the interior of this wall is covered with paintings and inscriptions, all of which must be copied and interpreted by scientists.

Yet when King Tutankhamen's 30-century sleep remains undisturbed, the discoverers have been repaid far beyond their dreams.



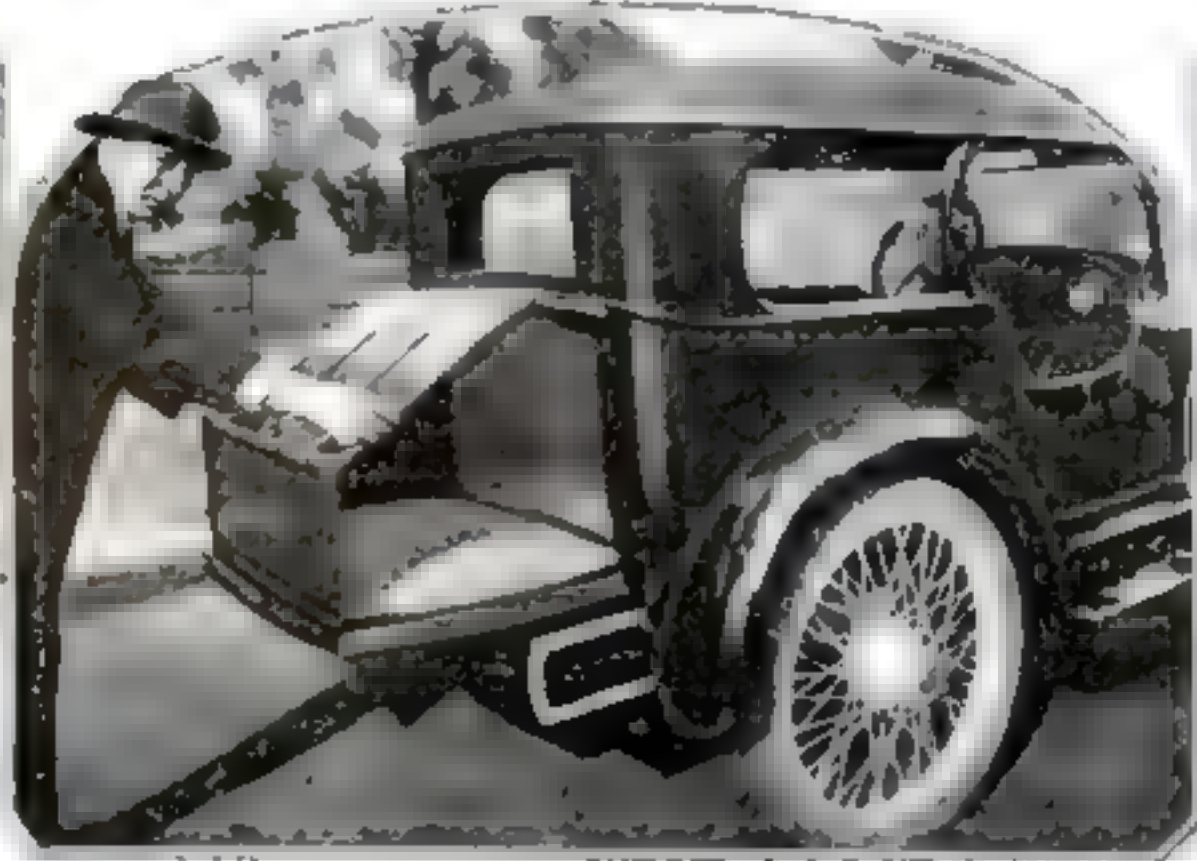
A life-size statue of the "lost Pharaoh," guarding the doorway of the burial chamber.

Conveniences for Spring Touring

A Comfortable Auto Bed for Two—Other Novel Accessories of the Month



A threadless dust cap for automobile tire valves is attached simply by pushing on it. It is held in place by a strong spring within the cap.



By opening a flap in the rear and lowering movable tonneau cushions, this car is speedily transformed into a sleeper for two persons.



The end of this rim wrench is a tool for removing clasher tires from wheels. The wrench section has two spanner holes that fit most rim nuts.



This car ignition lock secures both the gasoline supply and the electric circuit. Each lock has a different combination that can be reset when the car changes owners.



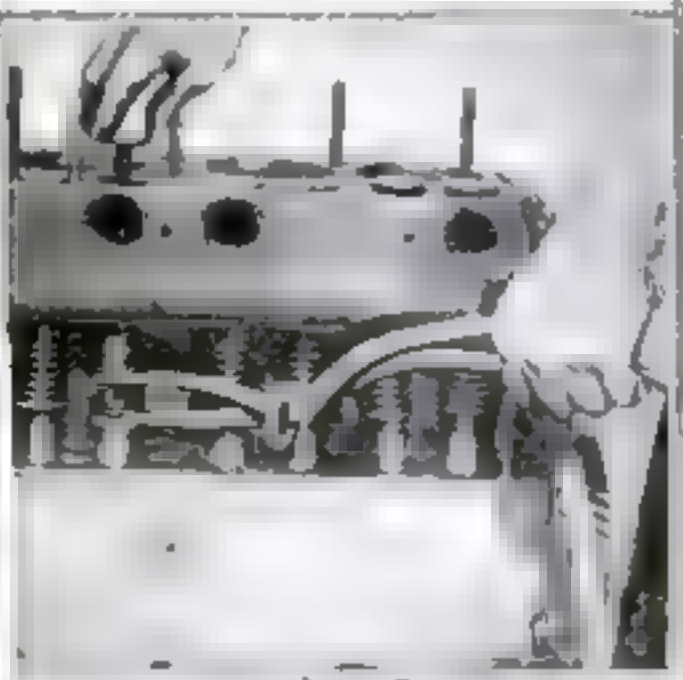
A leather pad, strapped around the heel, protects the shoe against wear while operating the accelerator. Since it is fastened to the shoe, it allows free movement of the ankle.



A small pad that fits snugly about the pedals and brake arms of Ford cars, under the floor mat, keeps out engine heat, dust and dirt in the summer and cold drafts in the winter.



Compartments in the doors serve to hold these side curtains and supports when they are not in use.



The ring on this valve spring lifter when drawn back, locks the tool after the spring has been compressed and leaves the mechanic's hands free to remove the valve stem.

How to Cut Your Car Costs

Auto Expert Tells Fifteen Every-Day Ways to Keep Expenses and Depreciation Down to the Ideal Low Mark

By H. F. Blanchard

"I'VE just bought a new car," the visitor across my desk announced, "and I've come to ask you how to keep my expenses down to the bone. In three years my last car cost me more than \$2700—upward of nine cents a mile. That's more than I can afford; but what can I do? I've heard men say they are able to keep their expenses down to five or six cents a mile. How do they do it?"

Anybody Can Save

His problem lies so close to the pocketbook of every automobile owner that I am going to repeat his questions and my answers, explaining important ways of saving car costs that anybody can practice successfully.

"Here is a little résumé of my expenses," said my visitor, showing me an itemized list of his costs for three years. The total was \$2795, or 9.3 cents a mile. That set me figuring; then opposite the items on his list I wrote "par" figures—that is, the ideal figures representing what his costs should have been if he had taken the proper care of his automobile.

My total was \$1900, or 6.3 cents a mile! In other words, he had wasted more than \$800 in three years.

"That's more like it!" he exclaimed, as he studied the "Ideal Figures." "Tell me how to do it!"

So I explained each of the 15 points that, if observed carefully, will automatically cut the expenses of any car to par. Here they are:

1. INSURE your car against fire and theft, and equip it with a fire extinguisher and a good lock. If you lose your car by fire or theft and it is not insured, you are adding to your expenses an amount equal to the value of your car.

2. PUT on spring bumpers front and rear. Bumpers are real insurance against collisions, and they protect the passengers. A bumper would have prevented that \$75 collision item on your expense list. If a car is equipped with a good bumper, you can run into a tree at 15 miles an hour and both passengers and car will come off unscathed.

Cost of new car three years ago	Original cost	1,295	
Value of machine now after three years depreciation		300	
		\$ 1,195	
Cost of tires	Original at 1,000 miles		
Replaced	6,000 -	50	10,000
Replaced	5,000 -	50	12,000
Replaced	4,000 -	50	12,000
Replaced	3,000 -	50	
Total mileage 30,000			34,000
Engine overhauled at 15,000 miles including new piston rings and bearing adjustment		100	
New batteries at \$15 each		50	
Oil and repairs after overhaul and burned out engine bearings caused by lack of oil		75	
Gasoline cost one tank of 12 miles per gallon and at a cost of 50 cents		750	15 miles per gallon 600
Worn valves, rockers, level gears and piston at 15,000 miles necessitated by inadequate lubrication		100	
Bumpers front and rear		—	50
Spinning at 15,000 miles		100	
Shock absorbers, shock at \$15 each, one due to wear and one due to broken bush		30	
Accidental repairs		75	
Total		\$ 2,795	\$ 1,900
Per mile		9.3 cents	6.3 cents

The left hand column of figures shows the items of cost for one owner's car for three years. The right hand column shows what these costs should have been if he had properly cared for his car.

The Typical Auto Owner

FROM figures based on many thousands of transactions, recently compiled by a great banking institution, the average American purchaser of an automobile may be described as follows:

He is a married man 33 years old.

He has a bank account and carries life insurance.

He buys a \$1400 car and pays \$700 down.

He pays the balance at the rate of \$100 monthly.

His monthly income is \$350.

He owns real estate in which his equity is \$5000.

He has personal property worth about \$2000.

This is not his first car.

3. DRIVE carefully and considerably. This advice means that you shouldn't run a new car much faster than 20 miles an hour for the first 500 miles. The same holds true after the engine has been overhauled. Five thousand miles can be taken out of the life of the engine by mishandling during the first 500 miles. Use your clutch and brakes gently and shift gears skillfully. Observe the rules of the road. Take no chances. **BE TWICE AS CAREFUL AS YOU THINK YOU OUGHT TO BE.** Thus accidents and premature repair bills—both large items of expense—may be avoided.

4. TO preserve the finish of your car, wash it frequently in clear, cold water. Never use hot water or soap on the body. Never keep the car in a barn; do not dust it and never allow mud to stand on it. Revitalize it before the varnish skin wears threadbare. Appearance is an important item in car depreciation.

5. NEVER put your top down. Modern top material soon loses its newness and cracks and tears when the top is put down.

6. LEARN to know your car and how to make all minor repairs. For other repairs find a good repairman and stick to him. It pays to have a man who knows the history of your car and feels a certain responsibility for its performance.

7. KEEP all nuts, bolts, and screws tight. Inspect the car periodically, especially electrical connections.

8. STEER clear of bargains unless they are real. Avoid second rate spark plugs, "gyp" tires, cheap lubricating oil and catchpenny money saving devices.

9. BUY good tires and keep them inflated. Always have a spare tire and tube with you. To be without a spare is to run risk of running a punctured tire and tube.

10. PAY cash for supplies, repairs, and gas and be sure to get your money's worth. Credit

fosters errors and dishonesty in the average repair garage.

11. AVOID extravagant expenses. Don't be like the man who incurred a \$10 taxi bill and a \$15 tow bill because his old battery finally laid down on him about three o'clock one cold morning. Don't spend \$10 a year replacing lost tools. Form the habit of taking a last look for stray tools.

12. DON'T postpone necessary repairs. For example, don't run with a loose bearing, or to this bill will be added the cost of straightening the crankshaft or perhaps buying a new one.

13. DON'T neglect your battery. Give it distilled water at least once a week, keep it charged, and prevent overcharging by turning on the lights. A good battery properly cared for will last for years. If neglected, it will last only six or eight months.

14. CHANGE the engine oil every 500 miles. Use high grade oil and the right kind of oil. Select a grade recommended by the manufacturer of your car and buy it in sealed cans to be sure that you are getting the real stuff. Follow the maker's instructions carefully in lubricating your car. Never put kerosene into your engine. A properly lubricated car will wear indefinitely.

15. KEEP your car in adjustment. This means the carburetor, breaker mechanism, spark plugs, valves, clutch, bearings, bevel gear, and steering gear, as well as many minor parts.

Returning now to my friend's statement of expenses, let's see just how the application of these 15 points would have saved him money.

The first item in his list—shown on page 75—is depreciation. He had just sold his car for \$200. It cost \$395. Therefore the depreciation during the three years he owned it was \$195. Remember that depreciation always must be included in car expenses; also, that depreciation is the difference between the cost of the car and the price you can get for it. The par figure in the second column shows that the car should have been worth \$400 when he sold it, or twice what he got for it.

"But why was my car worth only \$200 when I sold it?" my visitor inquired.

"Because of numerous shortcomings that you have indicated," I told him. "It needed painting badly, the engine was noisy and lacked power, the tires were worn out, the battery was in bad condition, the upholstery was scuffed, and the top leaked.

"You used five sets of tires, including the original equipment. The first set went 8000 miles, and the others ran from 5000 to 6000 miles. You bought a variety of makes and a great many so-called bargains. In addition you failed to inflate your tires, you skidded corners, drove in wet car tracks, and frequently locked the rear wheels. Your tires cost you on the average

of \$20 each, but your total bill was \$320. It might have been \$200 if you had bought first class tires and cared for them properly.

"At 15,000 miles you required new piston rings, adjustment of the engine bearings, and new valve parts. Why? Because you bought any old oil and changed it hardly

pistons, rings, and cylinders. Neglect of lubrication caused the bearings to wear rapidly.

"If you had changed the engine oil every 500 miles, or every 1000 miles at the most, if you had never allowed the oil to get low or the water to boil away, the chances are that the original rings would still be giving good service.

"One of the new batteries that you bought was ruined by fast driving and lack of water. That was an expense that might easily have been avoided.

Bumpers Save Damage

"You had a collision that cost \$75. You were lucky that it did not cost \$500. Probably it might have been avoided entirely by the exercise of a little more care, but surely even this small damage might have been prevented if the front of your car had a spring bumper.

"You should have averaged 15 miles to the gallon, but the fact that you got only 12 is largely due to careless carburetor adjustment, general car condition below par, and your failure to see that you got all the gasoline you paid for.

"At 25,000 miles you had to buy new valves and new valve rockers. The latter would never have worn out if they had been lubricated regularly.

"You repainted the car at 15,000 miles and yet it looked threadbare when you sold it. This was due to a combination of things. First, you kept your car in a barn, and residual ammonia fumes remaining about the structure ate off some of the varnish. Then you used body polish. The average polish, while it improves the appearance of a car temporarily, causes the varnish to lose its luster prematurely. Finally, your garageman used strong soap and water. To keep your car looking well you should wash the body in cold water only, although it is permissible to use soap on the running gear. Soak the dirt off with a gentle stream from a hose, sponge the body gently, and dry with a chamol. Have separate sponge and chamol for the running gear. If you have a convenient place to wash your car and good equipment, including rubber boots and apron, you'll be surprised how quickly it can be done.

Why Brakes Wear Out

"You had to have your brakes relined twice—once because of excessive use and abuse (and this explains some of your tire trouble), and once because the brakes were adjusted too tightly and you burned the linings.

"By a little forethought you can avoid a host of unnecessary expenses, such as the loss of tools, lap robe, spare tires, loss of the use of your car, needless repair bills, overcharges, accidents, fines for speeding, etc.—all expenses that could be avoided.

"There is just one item in which you need never economize.

It is oil. High grade oil, and plenty of it, is the cheapest thing you can buy.

"Finally, watch the fifteen points and, by unceasing vigilance, keep your rate of actual depreciation as close to the ideal line as possible.

Three Important "Don'ts" for Car Owners



Don't let nuts, bolts, and screws loosen. An auto is the most perfect device yet invented for shaking things apart.



Never use hot water, soap, or duster on the polished body of your car. Wash it in clear cold water.



Don't fail to insure your car as protection against thieves. Theft and fire are the most expensive of all expenses unless you carry insurance.

once in 5000 miles. You frequently forgot to push the choke in, thus flooding the cylinder walls with gasoline. Also you let the oil run low on two or three occasions, and twice you let the water boil away. All these things caused excessive wear of

Champions Show How to Change Tires Quickly

HOW long does it take you to change a tire?

Do you dread the job more than any other job about your car? Do you bang the rim with a hammer and skin your knuckles trying to get the stubborn tire off?

If so, you may be encouraged to know that all the drudgery can be eliminated once you have the right kind of tools and learn a couple of simple tricks. So says "Lightning Jim" Kennedy, of Seattle, Wash., who holds the world's stunt record for changing a tire in 22 seconds.

"The changing means a lot more than attaching an inflated spare, already mounted on a rim, to your wheel," he says. "It means removing the tire from the rim, taking the tube and flap out of the tire, putting in a new tube, and replacing the tire again."

Experience and the Right Tools

Fred A. Schmidt, Jr., of Milwaukee, Wis., who holds a somewhat different sort of record, is another champion who says that tire changing can be made simple and easy. In a recent contest he performed the operation of jacking up the car, deflating the tire, removing tire and tube, inflating the tire with a hand pump and pushing the car off the jack—in all three minutes and 31 seconds.

Both champions say that the secrets of their speed are two.

The right tools.

Experience.

Kennedy, working on a split rim—a rim that is not continuous, but cut through on one side—uses the ingenious tool shown at the bottom of the page to break the rim and release the tire. The tool resembles an automobile jack with a crank and a bevel gear drive to a screw head. Some sort of a tool of this type is almost essential for quick work in breaking a split rim, he says. He also uses a tire iron, one end of which resembles a screwdriver with a slight bend in it.

Loosen Tire Evenly All Around

In hanging up the long-distance record, Champion Schmidt worked on a Ford 30 by 3½ inch clincher tire, mounted on a solid rim—that is, a rim that is not collapsible. In this case the tire must be pried off the rim with a hand tool. The best way to do this, he says, is to push the edge of the tire casing from under the lip of the

rim and pry the edge free, repeating the operation all around the tire until the outer bead is loosened. The most common mistake in removing a tire is to force the tire off at one place, opposite the valve stem, causing the bead of the tire to bind.



Fred A. Schmidt of Milwaukee, Wis. setting a Ford tire changing record of three minutes and 11 seconds, beginning by jacking up the car and ending with the tire fully inflated by hand.



How "Lightning Joe" Kennedy attaches his tire-changing jack. As he turns the handle, the three brace arms split the rim.

Once the rim is broken, he pries the ends apart with a convenient hand tool, one end of which is shaped like a chisel.

In the third operation he turns the jack handle until the rim is fully contracted, then quickly lifts the rim from the tire.

Slipping the rim back in place with the aid of the hand tool, he gives the handle a few turns and the job is done.

Handy Toolboxes You Can Make for Your Car

ANY motorist can build a tool compartment for his car that will meet his needs better than the ordinary underseat toolbox. The usual box is objectionable because the tools are not readily accessible and the space is too limited for carrying an adequate assortment, but an ample kit can be carried conveniently in a tool compartment built into the left front door pocket, or placed in a tray box countersunk in the runningboard, or housed in a compartment built over the gasoline tank.

In many ways the toolbox in the runningboard is attractive. It utilizes space that is going to waste and yet offers the maximum convenience.

Toolbox Built under Runningboard

The runningboard is first removed and carefully sawed through at the runningboard irons, as shown, so that it forms a hinged cover to the toolbox. Under this cover is a tool tray large enough to accommodate the more ordinary tools. This tray lifts out and underneath is a tool compartment 6 or 8 in. deep. It carries the jack, tire pump, chains, and various odds and ends.

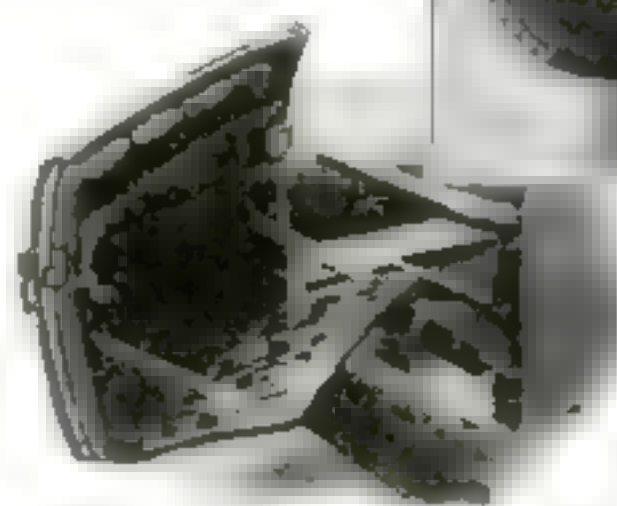
In order to support the section of runningboard at each end, a flat metal plate should be placed on the runningboard iron. The plates are bolted to the runningboard iron. Door hinges will serve for the hinges.

The exact dimensions of the box depend on the width of the runningboard and the distance between the runningboard irons. The box proper is best constructed of 3- or 5-ply wood approximately $\frac{3}{4}$ in. thick, but if this is not easily obtainable, oak or pine may be used. Use plenty of screws because of the car's vibration. The box is attached by cleats to the runningboard.

The obvious way to make the tray is to take a soft wood board of the right size and carve out a space for each tool; but an easier way is to make the tray in two pieces and cut the forms of the various tools right



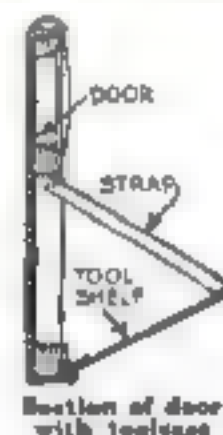
The tool tray shown above lies directly beneath the runningboard and covers a surface. The compartment at the right is built over the gas tank and has access in the right front door.



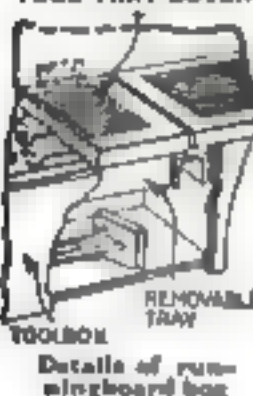
others are rolled up in a tool bag and kept within the compartment.

In making a tool compartment over the gasoline tank, the first step is to lay a floor about $\frac{3}{4}$ in. thick on the gasoline tank. Wooden ends of suitable shape are then made up and over a curved sheet metal cover, fixed at the bottom, is attached. This cover is bent to shape by wooden cleats, as shown. The cover may be attached to its frame by round head screws or, if a more perfect job is desired, the surface of the metal may be countersunk and, after the flat screws are put in place, the countersunk spots filled with solder and scraped to a smooth surface.

If a kit of properly selected tools of good quality is kept handy in any one of these three ways, the motorist will find that roadside repairs are not nearly so irksome as they usually are. The right tool will come to hand instantly, and having the right tool is half the battle.



TOOL TRAY COVER



through one $\frac{1}{4}$ -in. piece with chisel or scroll saw. This piece is glued to a $\frac{1}{4}$ -in. bottom board. When the tray is finished, felt may be glued to it to prevent the tools' rattling.

The left front door may be utilized by cutting away the upholstery between the middle and lower cross braces on the door, and fitting in a leather tray, hinged at the bottom so that the tray will close the compartment. The tray is made of two thicknesses of leather, with $\frac{3}{16}$ -in. wire reinforcement around the edge. Stitching the two pieces together with the wire in place can be done in a few minutes by any shoemaker. He can also supply you, as a rule, with the necessary leather.

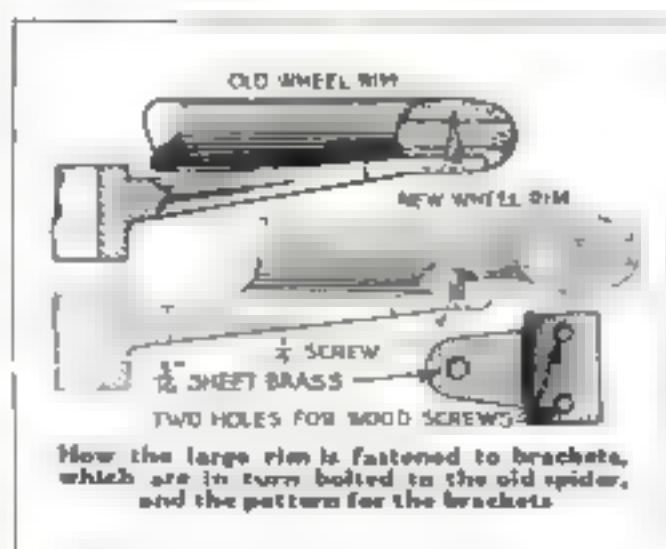
The tools most frequently used are mounted on the tray, as shown, and the

Attaching a Large Steering Wheel

By Joe V. Romig

TO REPLACE a small steering wheel with a larger one is neither expensive nor difficult, if the method illustrated is followed.

Four small brackets made of thin sheet steel or brass are cut to the shape shown, and the rectangular end is rounded to fit the contour of the lower side of the rim. The other end is then bent to the angle required and two holes are drilled through it and countersunk. Through these holes pass the wood screws used for fastening



for the brackets. Made in this way, the alteration is not difficult, costs little, and is strong and durable.

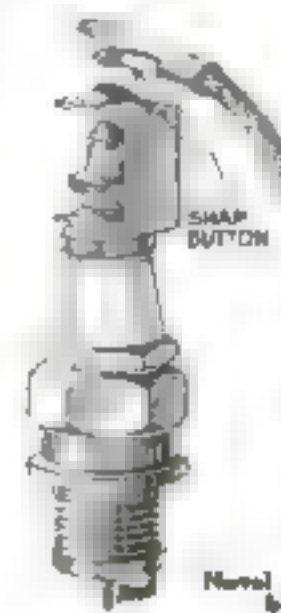
the bracket to the rim.

When the brackets are assembled on the new rim and screwed fast, they are placed on the spider and carefully centered. The holes for the bolts are then marked and after they have been drilled, the new rim is bolted in place. Bolts $\frac{1}{2}$ in. in diameter are strong enough, and $\frac{3}{16}$ -in. sheet metal will serve

Two Spark Plug "Kinks"

BY USING auto curtain snap buttons as shown, a tight spark plug connection is insured.

Another kink is to tap a piece of metal to take a spark plug and then fasten it to the motor. It serves for testing and holds a spare plug.—L. S.



Novel connection and testing block for spark plugs



The Home Workshop

Arthur Wakeling, Editor

Attractive Pergola Garage Costs Little to Build

BETWEEN 800,000 and 900,000 autos will be sold to new owners in 1923, according to a reliable trade estimate. If you are one of this vast army of new motorists, and if you have no place to store your new car, you will find many interesting and money-saving suggestions in this article on garage building.—THE EDITOR.

NO HOME worker who has a reasonable amount of leisure time need go to great expense to provide himself with a garage. The one illustrated

costs only from \$150 to \$200 for materials, complete with cement floor, doors, sash, and hardware.

The pergola roof effect at once distinguishes this garage as different from the stock designs usually seen, and at the same time has the great advantage of allowing a very simple type of construction to be used throughout.

The building is simply e shed with a flat roof sloping toward the rear. After it is framed and the roof and doors are on, a



Hanging the door

1 by 10 or 1 by 12 in. board is fastened at each side so that the upper edge is even with the highest point of the roof at the front. The board runs back on the level and therefore conceals the slant of the roof. The ends are shaped to conform with the design selected for the ornamental beams, and are doubled in front to give the effect of a 2-in. thickness.

After the roof has been covered with a prepared roofing, the top beams, which are purely ornamental, are put in place. Those in the rear are blocked up from the roof to take the greater part of the weight off the side boards. Two long strips, 1 by 2 in., are nailed on top near the ends of the beams to brace them.

Pilasters Ornament the Front

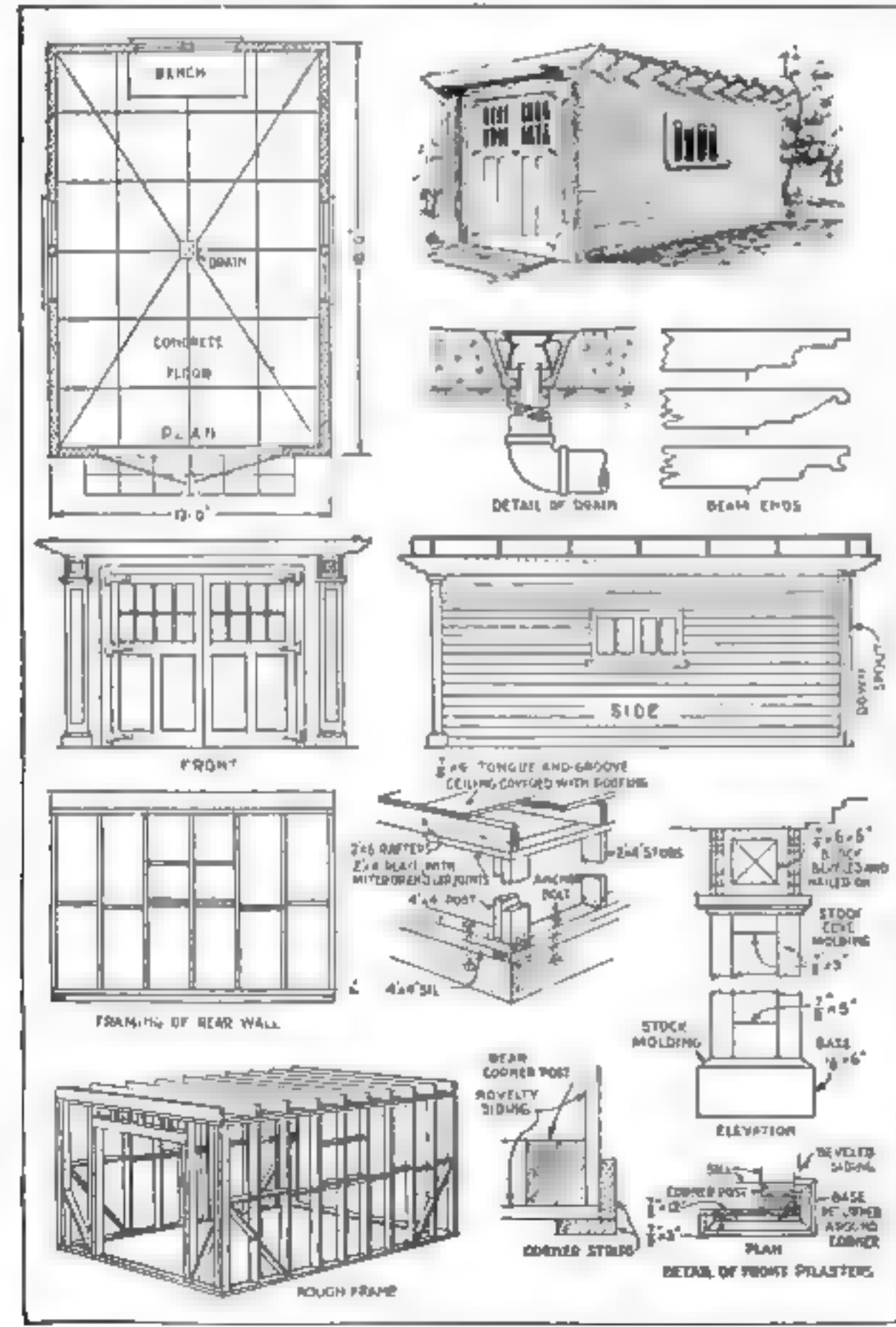
The front is further ornamented by two plain pilasters. As shown in the accompanying detail, they are simply 1 by 12 in. boards nailed to the corners. At their top, on the inside, are attached two false beam ends corresponding with those at the outside. Below these is a plain cap and molding. Narrow strips nailed to the pilasters give them a paneled effect, and a base of 1 1/4 in. by 6 in., with a stock molding, is provided at the bottom. The base and cap are returned around the 1 by 4 in. piece on the side that forms the corner piece against which the siding is butted.

Dimensions that have been found generally satisfactory for this type of garage are 12 by 18 ft., the studs being 8 ft. long. If it is desired to do much work in the garage, it can profitably be made 20 ft. or more deep, so as to give more space around the workbench.

The doors are 4 by 8 ft., the opening being 3 by 8 ft. It is usually best to buy the sash and frames, although they can be made. Light cellar sash, with 8 by 12 in. glazed panes are used at the sides and back.

In the case of the doors, the usual type with cross braces showing do not look quite as well in this design as those with vertical panels. The doors can be obtained quite reasonably, usually for not much more than \$25 a pair, but the home worker can, nevertheless, save a little by making them

(Continued on page 102)



Front and side views of the garage, the plan, and details of the framing, corner construction, ornamental pilasters and beam ends, and drain connection

Homemade Instruments for Running Simple Surveys

ALMOST any simple bit of surveying, such as locating boundaries, mapping small or large land tracts, running a profile for the location of drainpipes, drawing contours as a basis for grading or landscape gardening, can be performed fairly accurately by means of wooden instruments that can be made quickly and cheaply. These instruments are a Harvard hand level, a plane table, a pin alidade, a plumb bob, and a chain. Any one can easily adapt to these simpler devices the instructions contained in standard surveying textbooks, written for instruments costing hundreds of dollars.

The Harvard level (Fig. 1) has been used for years at the Harvard Engineering Camp for getting the contours for preliminary railroad surveys. It can be made entirely by hand at a cost of only a few cents, but the quickest way is to sacrifice a drafting-room T-square in its construction.

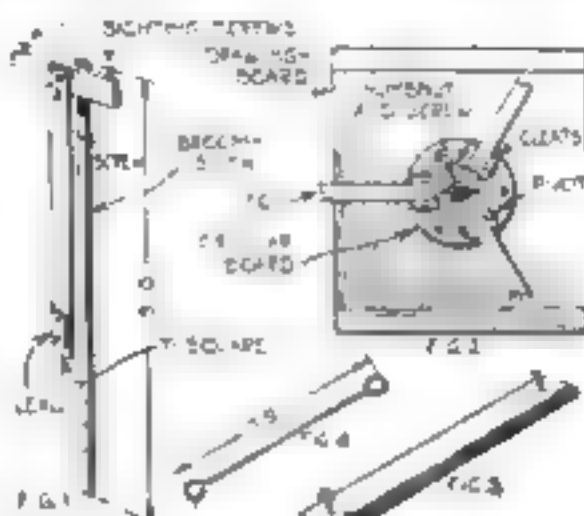
Bore a hole through the middle of the T, and drive a screw through this hole into one side of the end of an old broomstick. On the end of the blade of the T-square fasten a slab of lead. Now, when the broomstick is held vertical, the T-square will swing like a pendulum, with the top edge of the T practically horizontal. Drive a small screw partway into each end of this top edge, so that the two screws will stand vertically. Saw off the bottom of the broomstick, so that the distance from top to bottom of the entire instrument is exactly 5 ft.

Used like Regular Level

The two screws are for sights. They can be made exactly level by screwing one or the other in or out, and can be tested by methods described in any reliable textbook. Leveling can be done as usual, but with an additional advantage. In ordinary leveling, "height of instrument" is a bit of information useful merely as one step in getting the elevation of the new point at which you are sighting; it does not give you the height of the ground where the instrument is standing. But with the

By Capt. Roger Sherman Hoar

Formerly Instructor in Plans, Railroad, and Geodetic Surveying at Harvard University and Senior Instructor of Advanced Military Surveying at the Coast Artillery School, U. S. Army



Harvard level, plane table, alidade, and a link of a surveyor's chain

Harvard level, by subtracting 5 ft. from the "H. I.," you always have the elevation of your point of set-up.

For a leveling rod, take a straight narrow strip of board about 5 ft. long and graduate it in feet and tenths. It will be easiest to read if the board is painted white and marked with red diamonds for the feet and black diamonds for alternate tenths, as shown at the right.

The plane table (Fig. 2) is constructed most easily by the sacrifice of a drawingboard. Three pointed legs about 4 1/4 ft. long are fastened 120 degrees apart around the edge of a circular board about 6 in. in diameter, and 1 in. thick, so that they will swing out from the center of this board. In my own plane table, I have screwed 6 cleats in pairs to the circular board, and then have used a long screw driven across from one cleat to its mate, as the pivot for the head of each leg.

A large screw, driven from beneath

through the circular board and into the center of the drawingboard, serves to lock the table top in place when it is oriented. An iron washer between the head of the screw and the bottom of the circular board will serve to make the device more permanent. Or, better still, sink a nut in the center of the drawingboard, and use a thumbcrew in place of the screw.

It is true that this plane table does not possess a universal joint for leveling the top, but in professional surveying, most, if not all, of the leveling is done by shifting the legs, and the amateur will find this to be sufficient.

Ruler Serves as Alidade

The alidade (Fig. 3) consists merely of an ordinary school footrule, with a screw in one end and a small round-headed nail in the other. You sight through the screw, across the head of the nail. To turn off horizontal angles, lay an ordinary protractor on the table, under the alidade. A similar protractor, tacked on the side of the head of the T-square of the Harvard level can be used for vertical angles. A plumb bob can be purchased for a few cents, or made with an ordinary toy spinning-top and a screw to hold the string.

To make the chain, cut iron telegraph wire or baling wire into nine-inch lengths, and bend loops in each end, so that the dimension, as shown in Fig. 4, is just 7 9/32 inches. Then 100 of these links will form a surveyor's chain of 66 feet, 10 square chains to the acre. If you prefer feet and inches, you can use 1-ft. links, and carry a footrule for the fractions, or buy a steel (or even a cloth) tape.

With this outfit and a good book on elementary surveying, any reasonably intelligent man or boy ought to be able to do any piece of surveying that is not important enough to call for the services of an expert.

To ADHERE properly, asbestos insulation should be applied to a boiler when it is warm and troweled to a smooth finish.

Portable Searchlight Operates on House Circuit

By H. H. Parker

A SMALL low voltage searchlight is a convenient device to have about the house where there is a 110- or 220-volt alternating current lighting circuit. If a garage or chicken house is located in a dark corner of the premises or if a strong light is needed in an emergency, a length of lampcord attached to the searchlight can quickly be plugged into any lamp socket or baseboard connection so that the light can be taken to the back porch, barn, garage, or wherever needed.

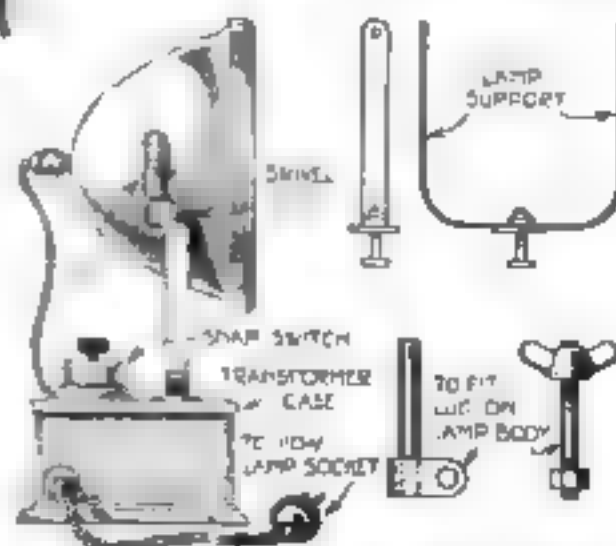
A regular automobile headlight or spotlight is used, mounted on a swiveling frame of simple construction, which is, in turn, attached to a wooden base containing a small alternating current transformer. The primary winding of the transformer is connected with the lighting mains through a snap switch and plug, while the secondary, or heavy wire, low voltage coil terminals are carried to the light. It would be impracticable to attempt to use the high voltage direct in a small reflector of this



The completed searchlight, which is adapted for 110- or 220-volt alternating current

type, so it is stepped down to either six or twelve volts, the customary auto lighting voltages.

The primary mains can be used on either 110 or 220 volts, depending upon whether the two coils are connected in parallel or



Homemade mounting for headlight is fastened with a swiveling joint to transformer case

series; a transformer of this or any other kind cannot be operated on a d.c. circuit. A capacity of about 100 watts allows large candlepower bulbs to be used, if desired; a 6-volt bulb up to 16 amperes can be lighted, or a 12-volt carrying 8 amperes.

No change is made in the headlight itself, but the builder will usually want to mount it in some sort of swivel frame, a spotlight can be mounted just as it is. One method of mounting is illustrated. Two lugs are made up of brass bar stock, and rods that just fit the bracket lugs on the lamp body are screwed into them. Then a piece of brass or steel flat stock is bent up for the bracket and the ends are drilled for the swiveling lugs, which are pivoted on bolts with wingnuts. The bottom is drilled for (Continued on page 116)

FREE—Book on Wood Finishing

S. C. JOHNSON & SON, Dept. P. S. 5,
Racine, Wis. (Canadian Factory—Brantford)

Please send me free and postpaid your instruction book
on Wood Finishing and Home Beautifying.

My dealer is

My Name

My Address

City & State

This book explains how inexpensive soft woods may be finished so they are as beautiful and artistic as hard wood. Tells what materials to use and how to use them. Includes color charts—gives covering capacities, etc. It is the work of experts beautifully illustrated in color. Fill out and mail this coupon.



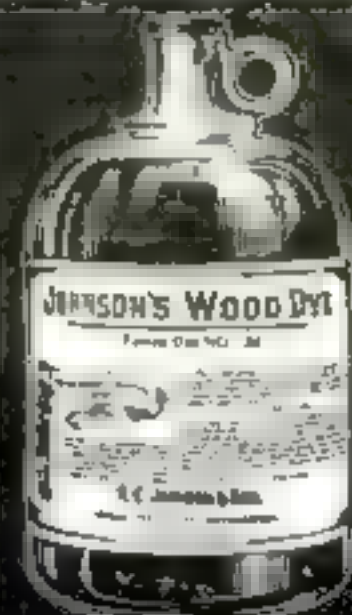
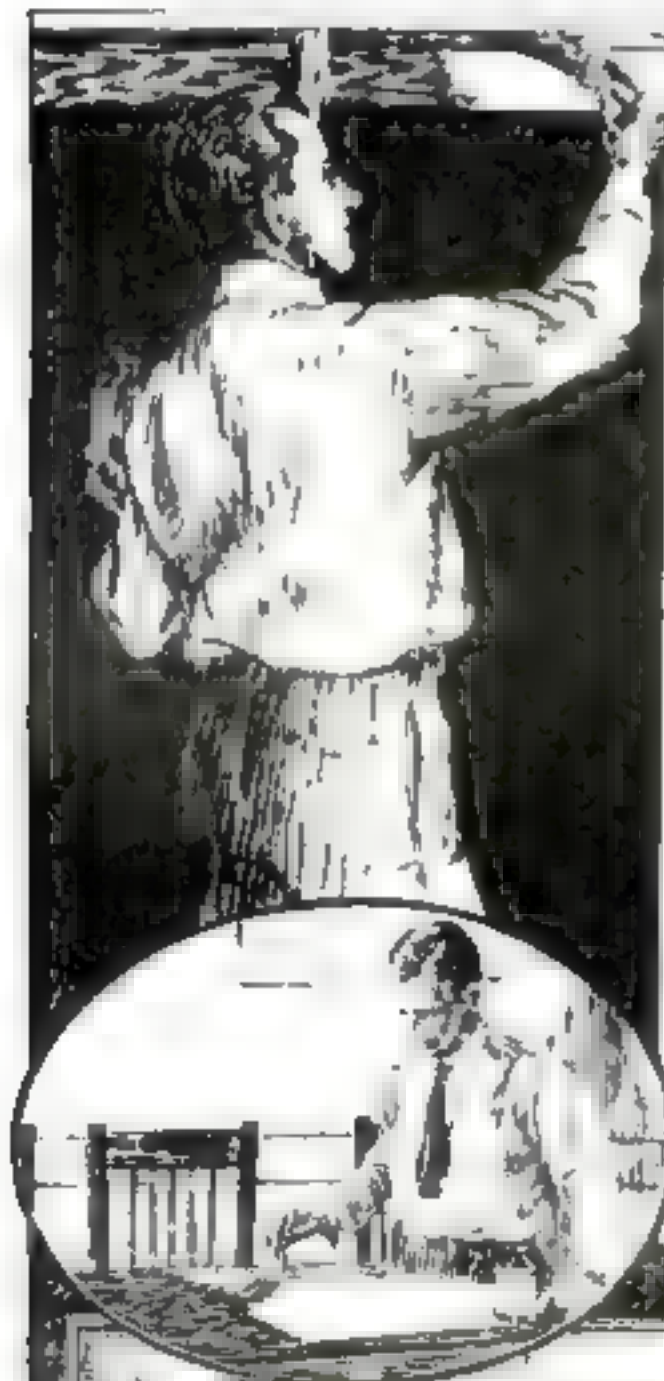
Tells How to Brighten Up Your Home

WELL finished furniture, woodwork and floors add materially to the beauty and attractiveness of your home. You, yourself, can easily refresh dingy, shabby, scratched wood. Our method involves practically no expense. All you need is a little time, a brush and

JOHNSON'S WOOD DYE

Johnson's Wood Dye is very easy to apply—it goes on easily and quickly, without a lap or a streak. It penetrates deeply, bringing out the beauty of the grain without raising it. dries in 4 hours and does not rub off or stand edge.

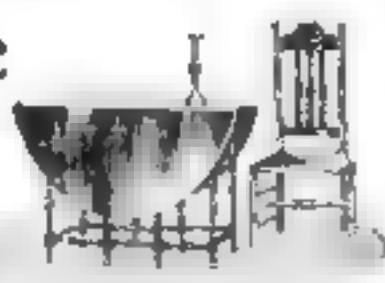
Johnson's Wood Dye is made in fourteen beautiful shades, all of which may be easily lightened or darkened—full directions on every label.





The Secrets of Making Realistic "Antique" Furniture

By James S. Godfrey



DO YOU know why antique furniture is now extremely popular—and justly so?

It is not because its rarity gives it unusual dollars and cents value, or because it is a reproduction that happens to imitate cleverly the appearance of costly old pieces. It is because it has that intangible but most desirable attribute called "character." It bears the stamp of the craftsman rather than the machine. Its surfaces are not hard and monotonous, but richly varied in tone and color, and the edges, moldings, and carvings have been softened by time.

A good antique has a sturdy, honest, livable look and a decorative value so marked that often a single piece, properly placed and displayed, will give beauty and dignity to an otherwise commonplace room. Decorators and architects have been quick to see and use this beauty of patina and softness of surface.

An antique is not, of course, necessarily better than a modern piece of furniture. Indeed, the reverse is often the case, and a modern reproduction may be better in respect to utility, durability, and charm than a genuine heirloom.

The home worker does not have to spend much money to provide himself with antique pieces. It is largely a matter of proper finishing. A cheap piece of furniture can often be purchased and, with a little care and patience, refinished until it has the distinctive tone and "feeling" of an antique.

The simplest, easiest and surest method of obtaining an antique finish on a piece of modern furniture is to remove the ordinary finish, as far as can be done, and refinish, and do this several times, if necessary. Don't take too much pains in removing the first finish. If the scraper tears off a corner here and there, the sandpaper bites too deep, the stain does not flow quite evenly, and the new finish is rubbed off in places, so much the better.

To imitate the dark color of the majority of antique finishes, dark commercial mahogany and walnut stains and oak stains of various kinds can be used. Fine effects can be obtained, especially on new work, simply by rubbing a penetrating water or acid stain of standard quality into the wood, sanding it with fine sandpaper when dry and then applying a second coat diluted about one half with water. Follow with a thin coat of shellac to fix the stain, and apply thin coats of wax, well rubbed in, or other flat finishes or even varnish, well rubbed to a dull or eggshell finish.

This is a good basic process to which the "antiquing" methods described hereafter can be applied in all sorts of combinations. It is frequently not necessary to fill the grain, but that depends upon the style of the piece being finished. For instance, fine Colonial furniture, such as made by Phyfe,



The charm of the antique is well represented in this oaken cupboard of the fifteenth century Gothic period.

was filled and finished most beautifully and in a way that can be imitated best only by the use of many coats of rubbed shellac or a real French polish.

A satisfactory stain for reproductions of mahogany Colonial furniture is made by dissolving $\frac{1}{2}$ oz. of potassium bichromate in 1 qt. of hot water. The solution is allowed to cool before applying to the wood, which must be sandpapered perfectly smooth.

If, for example, an inlaid mahogany table has been made, the chances are that the wood used is a relatively light variety of mahogany,

often known as baywood, and not the dark San Domingo mahogany used by Colonial cabinetmakers and still used for especially fine pieces of furniture. The mahogany will have to be darkened artificially, so one coat of the potassium bichromate should be applied. It will be a dull brown color when it dries and if it does not seem dark enough, a second coat should be put on. Then sandpaper it a little and continue the finish as if the wood were naturally dark mahogany. The inlays should be shellacked with white shellac and a coat of dark mahogany oil stain applied, followed by half a dozen or more very thin coats of orange shellac. Each under coat should be rubbed down with pumice stone and oil, and the last coat with rotten stone and oil.

On open grained woods like oak, a wash of cream, gray or light brown flat oil paint can be brushed into the grain in place of a filler and rubbed off, so that the grain is more or less accentuated, and the use of "toners" in this way can be used to produce many effective finishes.

Ordinary stains can be supplemented with the best grade of asphaltum obtainable and oil of turpentine; this gives a brown and aged appearance to wood, but should be applied with discretion, and rubbed well into the grain of the wood with wax. Logwood or the green shells of black walnut boiled in water also gives a stain utilized for this work, both for oak and walnut. Tincture of iodine, from the medicine cabinet, is another good brown stain if it is well covered with shellac wax, or varnish.

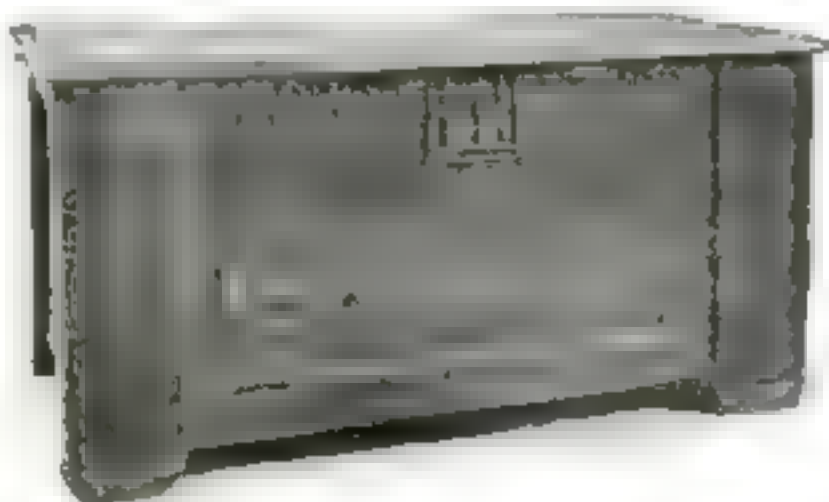
Apply a little nitric or sulphuric acid in places, so that the surface will be eaten away and colored at the same time. Brush the spots well, neutralize the acid with household ammonia, and wash them with warm water. In connection with this much used process, permanganate of potash, another invaluable stain for the "antiquing" process, frequently serves for giving colors.

In place of fuming oak, it can be darkened simply by brushing it with liquid ammonia or bichromate of potash. New oak, when made up, can be aged by whitewashing it with fresh lime, which should be brushed off well after it is dry. Linseed oil or wax is then rubbed well into the grain. Several coats of a strong solution of washing soda will give a somewhat similar result.

Another antique finish is the so-called "Sugi" treatment of cypress. The Japanese have for ages used driftwood in making beautiful pieces of furniture. The surfaces of the wood, being



The amateur craftsman can easily duplicate this American table, made about 1780.



A reproduction of this fine fourteenth century English chest is within the capacity of every home workshop.

(Continued on page 108)



TYPED WORDS ARE WINGED WORDS!

Is it not a fact that words are surely as easy to write as they are words easily written and pleasantly read?

In the modern world, where the man's work and woman's social activities—words play a great part in the life of the individual.

Is it not a fact that words are surely as easy to write as they are words easily written and pleasantly read?

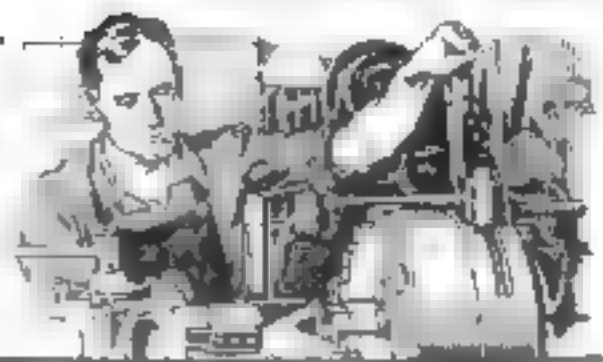


UNDERWOOD TYPEWRITER COMPANY, INC. UNDERWOOD BUILDING, N. Y.

UNDERWOOD PORTABLE

Better Shop Methods

How Expert Mechanics Save Time and Labor



Sturdy Bench Shaper Cuts Production Costs

By Joe V. Romig

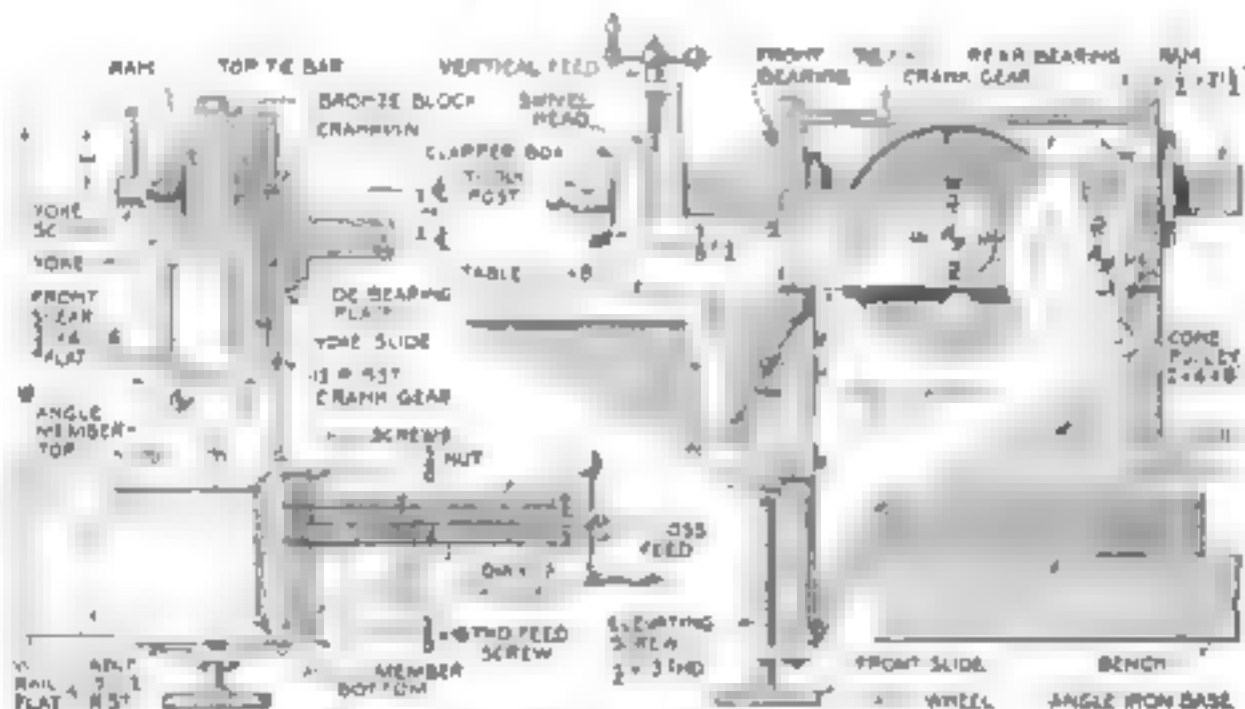
ANY machine shop, however small, is incomplete without a shaper. Even the experimental shop should have a shaper for the machining of flat surfaces.

Much of the work done nowadays on the shaper was once done by chipping and filing. Rather than go to the expense of buying a bench shaper, the mechanic in the small shop can make one of his own that will be a sturdy, true-running machine, with plenty of power to take good cuts. It will also be very accurate, if pains are taken with every detail in building it.

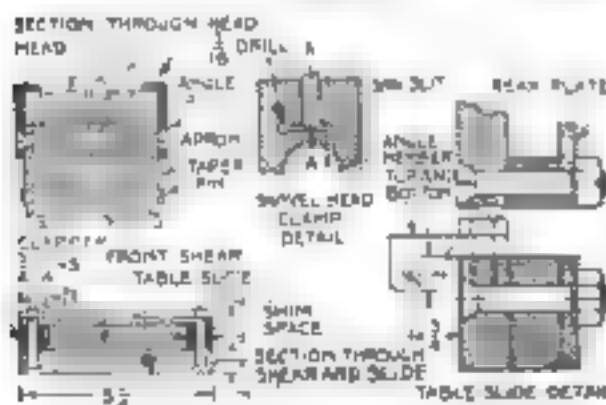
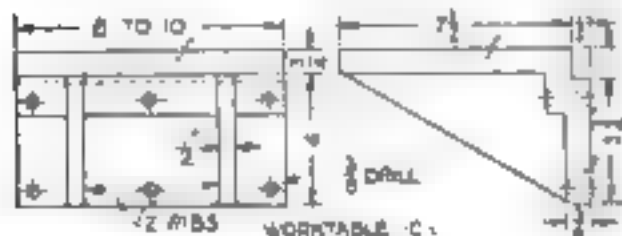
This 8-in. crank shaper was designed to eliminate as much troublesome and expensive machine work as possible. Use is made of cold rolled steel flats, which are procurable at any steel sales company's store, for most of the accurate surfaces. The only casting required is for the worktable, which cannot be made out of stock shapes because of its peculiar form.

The shaper has a variable stroke of from 2 to 8 in. in length, and the ram can be placed in any position by means of a clamping yoke member. The head swivels and can be set at any angle for dovetails and similar work. A novel arrangement permits locking the head firmly in any of its angular positions.

A substantial gear reduction provides



Front view, partly in section, and side view of the bench shaper, which has a stroke of from 2 to 8 in., a tool head travel of 2 in., a vertical table travel of 6 in., a horizontal table travel of 7 in., an area limit of 6 by 7 in., and a three-speed drive.



Details of the cast iron worktable, table slide, head slide, and clamp for the swivel head.

the power necessary for heavy cuts and three speeds are available for the efficient operation of the tool. A $\frac{1}{2}$ -hp. motor is strong enough to run this machine, the drive being throughout an overhead countershaft.

In constructing the machine tool, a piece of 10-in. channel iron is cut for the frame, as shown, and shaped off true to bring the two outside faces parallel and square with one another. This channel iron, as well as the steel flats, can be bought for a few cents a pound. A piece of $\frac{3}{4}$ by 5 in. cold rolled steel should be bought in one piece, 60 in. long, so that the builder can cut it to suitable lengths, as required.

Test all flat stock for straightness and parallelism of sides. If out of true, straighten it with files and scrapers and check with straight edge and micrometers. A front and rear are cut, drilled, and countersunk, and are then attached to the channel iron frame piece with flat head screws. Make all countersinks deep enough, so that the flat screw heads will seat about 1-32 in. below the surface of the flat. To insure all screws being seated perfectly, tap on the screwdriver with a

hammer and pull up dead tight. The front and back plate must line up exactly right, as the ram bearings are carried in these two pieces.

For the base, two pieces of angle iron are bolted to the channel, spacers being used to fill in the opening of the channel.

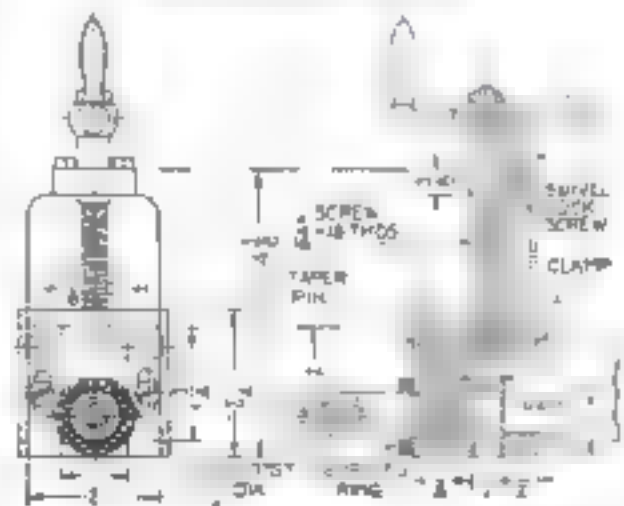
Bearings for the ram are made either of Babbitt metal or a good grade of bronze. They must fit snugly in the two holes bored for them in the front and back plates. These bearings are held in place with $\frac{1}{4}$ -in. screws.

The ram is a single piece of $1\frac{1}{2}$ -in. square cold rolled steel, carefully checked for size and straightness. The front end is turned down to $1\frac{1}{4}$ in. diameter and is threaded as shown on page 86.

The head is built up of $\frac{3}{8}$ by 2 in. flat stock. The slide plate is bored and threaded to fit the nose of the ram. The clamping arrangement is shown in detail. A hole is drilled to one side of the center line, and two saw slots at right angles to one another connect this hole with the threaded bore. A screw neatly placed in the center of the piece tightens against this weakened portion of the threaded bore and clamps the lug against the male threads on the ram nose.

A piece of $\frac{1}{2}$ by 2 by $2\frac{1}{4}$ in. forms the sliding base of the clapper box. This is held to the slide with angle iron strips, as shown. It is drilled and tapped for the vertical feed screw, and is also counterbored slightly for the reception of the boss on the rear side of the clapper box proper.

Continued on page 87



Front view and section of the assembled head, showing the mechanism of the vertical feed.

THE SIXTH SENSE OF INDUSTRY

Tycos Temperature Control

*If sense of "taste"
sufficed the canning industry!*



The
SIX SENSES
Seeing
Feeling
Hearing
Smelling
Tasting
and
Tycos
Temperature
Control

If the fitness of cooked food—its readiness for canning—were gauged simply by its taste, then ptomaine poisoning would be a scourge of the human race instead of a rare occurrence. The essence of successful food preservation is perfect cooking, to render the foods sterile, to kill the bacteria which cause decomposition. The essence of successful food sterilization is the accurate indicating, recording and controlling of temperatures. There is a well defined temperature point at which foods should be sterilized to insure the bacteria being killed. This cannot be told by the sense of taste or sight or any of the other familiar senses, but it can be—and is, absolutely assured by the "sixth sense" of industry—Temperature Control made possible by Tycos Instruments.

Food in cans is sterilized by being heated by steam in pressure chambers. The canner cannot depend on

the usual senses for knowledge that the contents have reached and are being held at the right temperature. Again the "sixth sense"—again the temperature control, made possible by Tycos Instruments, plays its part.

It is a tribute to the accuracy of Tycos Temperature Indicating, Recording and Controlling Instruments that the use of successfully canned goods is worldwide today. It is significant that Tycos Instruments are regarded as the standard of accuracy in big canneries everywhere.

Is your business, your industry equipped with the "sixth sense"? Certainly among the more than 8,000 different types of instruments in the Tycos Line are the ones exactly suited to your needs. Tycos Engineers are prepared to advise you in their installation. Literature on any type in which you are interested will be sent upon request.

Tycos in the Home

Tycos Wall Thermometers
To help you maintain a temperature in your room conducive to good health.

Tycos Stomachade
To assist in the digestion of food, four hours ahead with dependable accuracy.

Tycos Office Thermometers
An aid in promoting human efficiency.

Tycos Bath Thermometers
To enable you to get the most good from your bath.

Tycos Quality Compasses
To show you the right way in orienting your property.

Tycos Fever Thermometers
A necessity in every home.

Tycos Hygrometers
To enable you to keep the humidity of your home at the right level at all times.

Tycos Home Set
Bake Oven Thermometer, Candy Thermometer, Sugar Thermometer, Boiling Water Thermometer, etc.

Your dealer will show them to you. Ask us, on a postal, for booklets on any of the above.

Tycos and the MEDICAL Profession

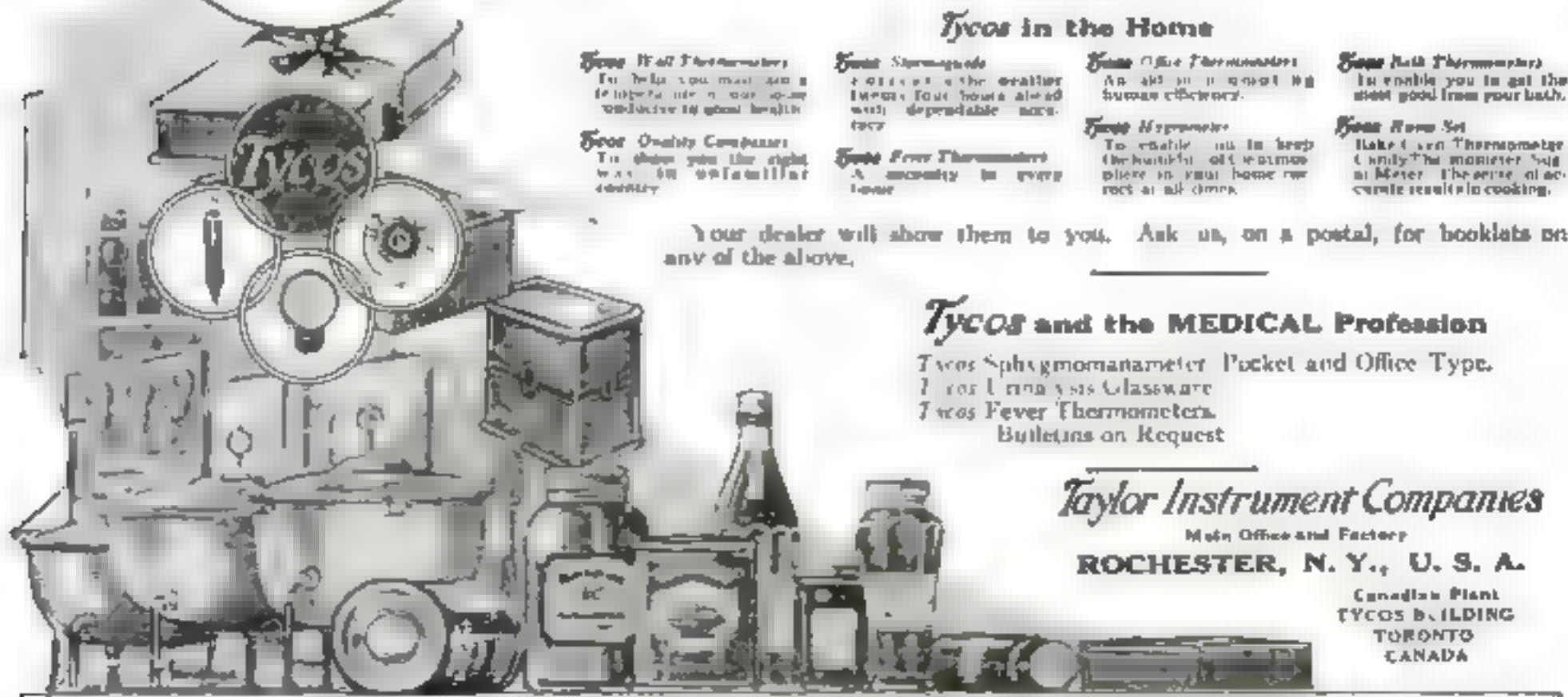
Tycos Sphygmomanometer, Pocket and Office Type.
Tycos Urinometer Glassware.
Tycos Fever Thermometers.
Bulletins on Request.

Taylor Instrument Companies

Main Office and Factory

ROCHESTER, N. Y., U. S. A.

Canadian Plant
TYCOS BUILDING
TORONTO
CANADA



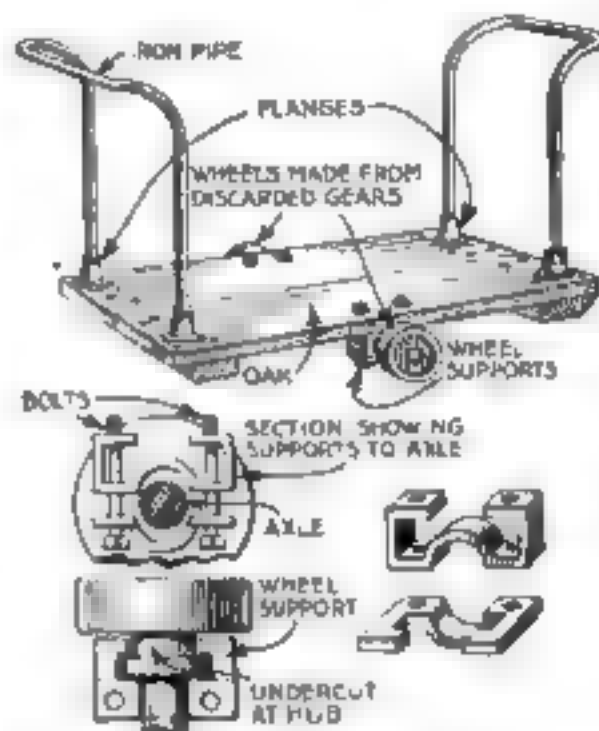
Tycos Temperature Instruments

INDICATING · RECORDING · CONTROLLING

BETTER SHOP METHODS

Cheaply Made Shop Truck
Handles Heavy Material

SIMPLICITY and cheapness of construction are the features of the small shop truck illustrated. The idea originated in a Washington, D. C., auto repair shop, where the truck is used for handling motors, transmissions, axle assemblies, and



The complete truck and detail of the wheels and axle bearing

the like. Being low, it is particularly good for hauling heavy materials.

The body is made of two oak planks with heavy battens at each end. The combination rack and handle at each end is made from a single bent pipe attached with floor flanges.

The wheels are turned from two old gears, the hubs being undercut to engage fingers on the special form of hangers used. They are of strap iron.—F. L. M.

Drilling and Tool Setting Gage
Placed on Lathe Tailstock

A DRILLING gage on the top of the lathe tailstock spindle has been a great help to me in my work. By starting the drill with the spindle set at the first mark, I am able to know at any time the exact depth of the hole as the work progresses without having to stop the lathe.

The tools required for making this gage are a 6-in. steel rule, dividers, center punch, cold chisel, hammer, and 1/8-in. hardened steel dies numbered from 1 to 4.

Take the tailstock spindle completely out of the lathe and transfer the inch marks by eighths from the rule to the center of the top side of the spindle by using the center punch and following it with chiseled cross lines. Then stamp the inch numbers as shown. Smooth the raised edges carefully with emery so that spindle will not bind when run in the first time.

Another aid is a short chiseled line with center punch dots on each end located on the side of the spindle exactly opposite the center of the lathe. This forms a fine gage for setting compound slide-rest cutters at the proper height.—J. M. ROLSTON



Valve Grinder
No. 747
Price, \$5.00

A new, easy-to-use
valve grinder

THIS new improved Valve Grinder is making a big hit with automobile owners everywhere. Simplicity of operation is the big feature.

Each upward stroke and each downward stroke of the operating handle gives 1-1/2 complete revolutions of the spindle. This makes easy, short, quick reciprocations, long reciprocations, or advancing reciprocations.

This new Valve Grinder is furnished with an extension that gives 5 inches additional length when desired—thus making a total of 11-1/4 inches below the gear.

The leverage obtained through the long operating handle and transmitted through a ball-bearing spindle makes grinding an easy job. Blade fits either slotted or spotted valves. Hardwood handles, mahogany finish.

Length over all without extension, 12-1/4 inches; length over all with extension, 17-1/4 inches; weight, 1-3/4 pounds.

1499 other good tools

Remember, this is but one of a big line of 1500 Good Tools—all made by skilled toolsmiths of long experience.

Send for catalog No. 15 which describes and illustrates other Goodell-Pratt Tools.

GOODELL PRATT COMPANY

Toolsmiths

Greenfield, Mass., U. S. A.

GOODELL- PRATT

1500 GOOD TOOLS



Mr. Punch says:
Believe me, that
new Valve Grind-
er will make any
automobile
owner his own
mechanic."

BETTER SHOP METHODS

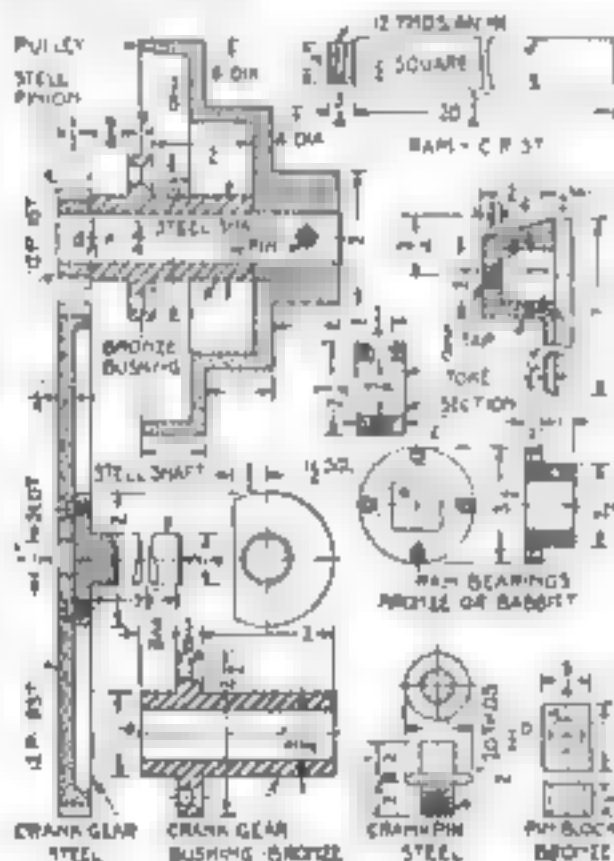
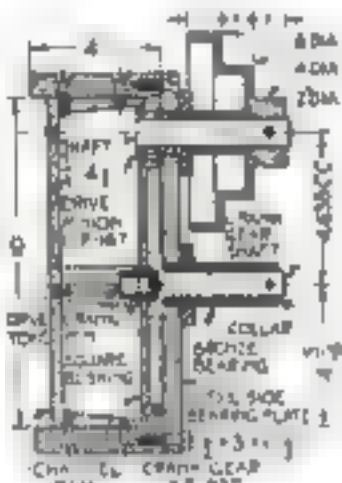
Sturdy Bench Shaper

Continued from page 84

The clapper box is made of thicker steel and has a boss turned on its rear face. Two slots on a radius allow the clapper box to be swiveled for clearance on the return stroke when working on vertical faces. Two 5/16-in. screws with a fine thread clamp the box firmly in place.

The clapper is drilled and tapped for the threaded end of the toolpost, and should be a neat swinging fit, without any lost motion. A taper pin holds the clapper in place in the box. Clamp the box and clapper together when drilling and reaming the hole for the pin. The ball crank handles can often be picked up in the shop from worn out machinery.

The drive is through a belt to a three-step cone pulley, then to the 18-tooth pinion, of 12 pitch. This in turn operates the big gear of 98 teeth, 12 pitch.



Sectional view through the driving mechanism (above) and details of the gearing, step pulley, ram and bearings, yoke, crank gear bushing, crankpin and pin block.

These gears are steel with a face wide enough to allow machining down to the sizes shown. The pinion is keyed to its shaft and the cone pulley can be fastened by a taper pin driven through both shaft and pulley. A bronze bearing for the shaft fits into a bored hole in the side bearing plate. This plate is made of steel or iron and is screwed rigidly to the edges of the two end plates. It is important to lay out the centers of the two bearing holes accurately, as the proper working of the gears depends upon their meshing correctly.

The crank gear is slotted in the web for the reception of the crankpin, as shown. A special shaft with an integral flange must be turned up for this gear. Gear and shaft are fastened together with flat head screws. The flange must be faced off on one side.

(Continued on page 88)

Combining six of the many uses of the Starrett Combination Square No. 1.

Seven Tool Uses at the price of a single tool

The Starrett Combination Square forms one of the most convenient and useful tools ever devised for machinists and mechanics.

Combining as it does the uses of a rule, square, miter, depth gage, height gage and level, it permits more rapid work on the part of the user and saves littering up the bench with a number of necessary but seldom used tools.

Not the least remarkable feature of this remarkable tool is the price—it's about what you'd pay for one of the seven tools it supplants. See this tool at any hardware store.

Fully described (with 2100 other fine precision tools) in the Starrett Catalog No. 22 "W" free on request. Write also for the Supplement showing the latest Starrett Tools.

THE L. S. STARRETT CO.

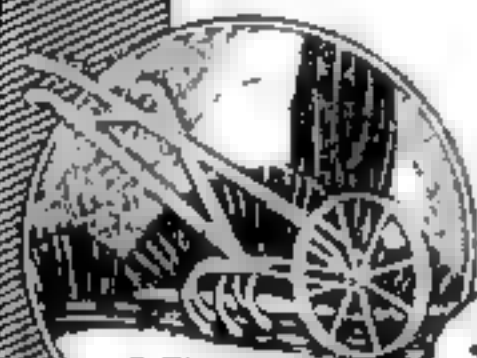
The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled

ATHOL, MASS.



Use Starrett Tools

The Files that work in the Spring

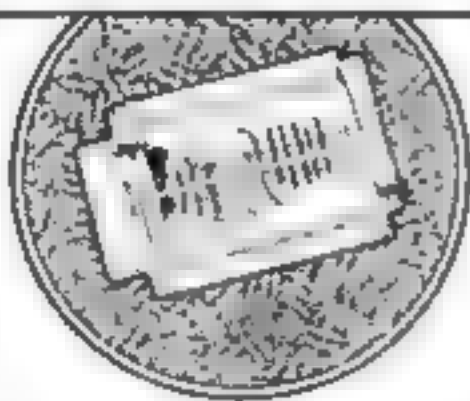


NICHOLSON
U.S.A.



RIGHT NOW...EVERYWHERE
NICHOLSON Files are busily
at work sharpening harrow disks,
cultivator teeth, saws, garden tools;
shaping and refitting parts in over-
hauled motor cars, trucks, gas engines
and pumps.

For every filing purpose, there's a right
NICHOLSON File. A file which,
because of finer temper, greater uni-
formity and keener cutting, has won
the confidence and respect of the
best workmen.



- 1 Use a NICHOLSON Mill Bastard File for sharpening harrow disks.
- 2 You'll find many uses for NICHOLSON Wood Rasps in constructing hen houses or cold frames.
- 3 Keep NICHOLSON Tungsten Point and Superior Platinum Point Files in your motor repair kit.

NICHOLSON FILE CO.
PROVIDENCE, R.I., U.S.A.

BETTER SHOP METHODS

Sturdy Bench Shaper

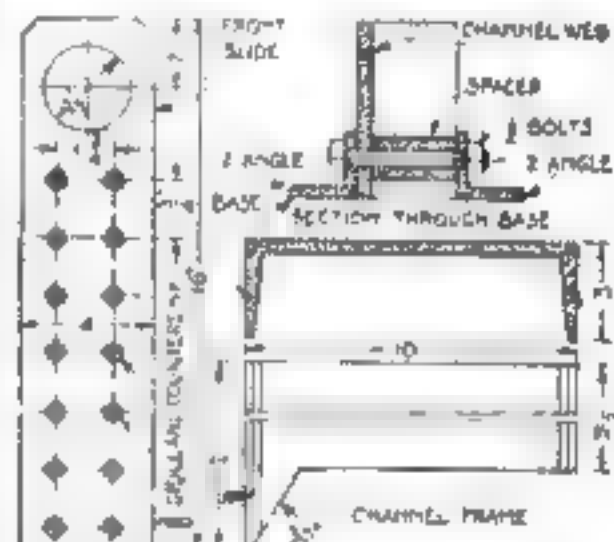
By W. H. B. S. A.

facing the slot, in order to allow the crank-pin to come back as far as possible. A collar, pinned to the drive gearshaft, holds it in place.

The yoke is a solid piece of steel, shaped to the size given in the details. Care should be taken to machine the interior surfaces of the slide to a high finish so as to reduce wear and friction at this most important place.

By having the yoke fastened to the ram by a single screw, the ram can be placed where desired, and can be extended beyond its usual range, as when planing a surface of greater length than its rated stroke, and when taking a double hitch at a surface.

As the working stroke takes place in one half of the whole revolution, the center



Details of the main frame and front slide, and method of supporting the channel iron.

of support has been shifted, so as to make all strains central as far as possible. On the return stroke, the pin overcomes only the weight and resistance of the ram itself and works in the lowered end of the yoke, which is the farthest away from the support.

The pin block should be fitted neatly to both pin and slot and should be made of good bronze. Under the point of the clamping screw of the yoke, place a thin piece of brass shim stock, to prevent marring the accurate surface of the side of the ram.

The table slide is built up throughout. A piece 6 by 5 1/4 by 3/4 in. forms the main part. This is drilled and tapped to the sizes given, and care must be taken to adhere strictly to dimensions. Angle pieces and cap screws hold the worktable slide or rail in place. Two pieces 1/2 in. square are used, together with 6 at 1/4 by 1 1/4 in. pieces to form the sliding box bearing. The screws are countersunk through the one piece, tapped and screwed through the 1/2-in. square pieces, passed through drilled holes in the thin plates, and finally clamped with nuts on the outside. This leaves a space on either side in which a thin brass shim is placed, which can be adjusted with the screws to square up the slide and take up wear.

The manner of holding the table is just the reverse of the usual practice. In this design the rail is made to travel through the slide and carries the worktable clamped to its front face. This arrangement gives great strength and makes it possible to use and maneuver the relatively large worktable. By having a large worktable,

(Continued on page 89)

BETTER SHOP METHODS

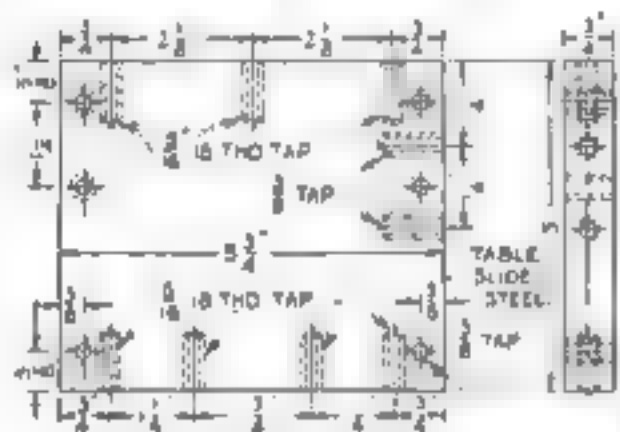
Sturdy Bench Shaper

(Continued from page 88)

jobs that usually would stump a machine of this size can be done

The feed arrangement is mounted on two standards, as shown, and permits the travel of the table in either direction to a distance of 9 1/4 in. or a total travel of 7 in., which is ample for a machine of this size.

The table itself is a casting made over a simple pattern, and it should be shaped up true and square. It is clamped to the table rail with cap screws, and several dowel pins keep it from shifting. To hold the work, many equally spaced holes should be drilled and tapped in the upper



Drilling and tapping the table slide must follow accurately the above layout

surface. A convenient size is 3/4 in. for the holes, spaced 1 in. apart. Countersink slightly to prevent burrs. A small vise is a necessary attachment for any shaper, and this can be clamped to the top face of the table in any position.

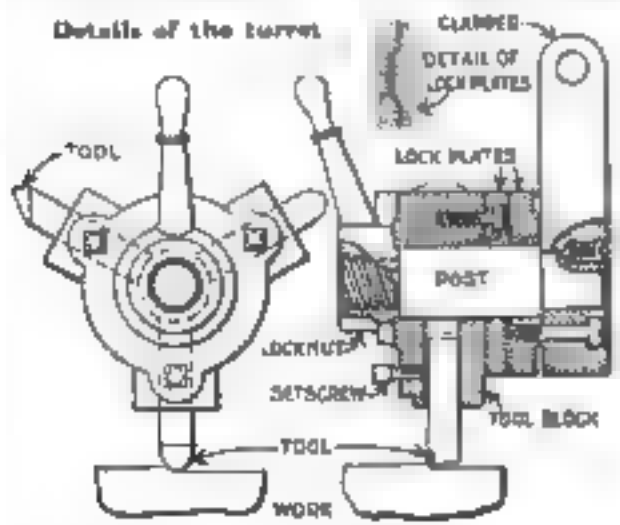
A bronze nut should be fitted to the rear of the table rail to engage the feed screw. An elevating screw that runs in a nut plate fastened to the bottom of the front slide plate, elevates and lowers the slide and rail when the clamping screws on the rear of the back plates are loosened.

The shaper should be mounted on the front of a solid workbench, and the countershaft can be mounted on the wall in the rear. Belts of 1 in. are sufficient for driving the machine.

Strong and rugged, accurate and true, this little shaper well repays the builder through the variety of work it turns out.

Turret for Shaper Saves Time on Duplicate Work

A TURRET for the shaper that saves time in changing tools when turning out duplicate work, may be made as shown. It holds three tools fastened with



setscrews, and when one shaping operation is completed, the locknut is loosened to permit the turret to be turned so as to bring another tool in position.—L. G.



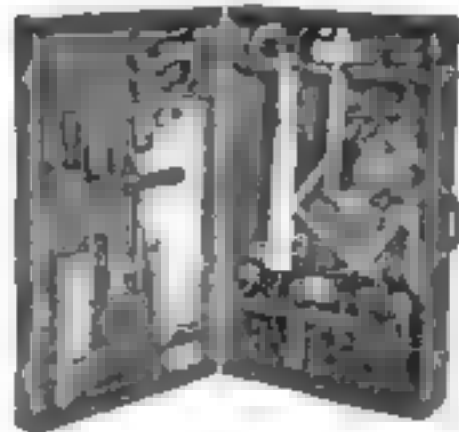
There's fun in using a Good Brace

There's real enjoyment in seeing the chips curl up and fall away, fun in making things with your own hands. More than that—there's mental relaxation from a long, hard day's work as well.

A Stanley Bit Brace is made for sturdy work by craftsmen who have received their training in the school of experience.

Stanley tools as shown in our No. 34 Catalog are well known for their dependable quality and workmanship. A copy of the catalog will be sent to those interested or see your hardware merchant.

Stanley Tool Assortments



The same tools that carpenters have used for years are now sold in Cabinets, Chests and Boxes. No. 903 Cabinet is shown at the left. Write for folder "7-B," illustrating these cabinets.

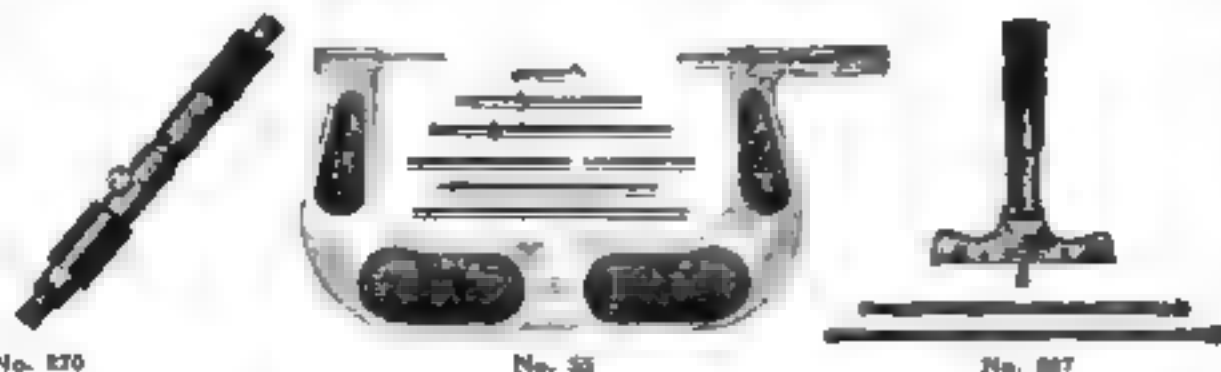
THE STANLEY RULE & LEVEL PLANT

THE STANLEY WORKS

New Britain, Conn.

New York—Chicago—San Francisco
Los Angeles—Seattle

STANLEY TOOLS



TOOLS YOU CAN RELY ON

You'll find that most mechanics use Brown & Sharpe Tools because they can rely on them. These tools have the accuracy and dependability built in them that gives you complete confidence that your work will be correct. The more good, accurate tools you have, the more good, accurate work you can produce.

You Can RELY On Brown & Sharpe Micrometers

The addition of a Brown & Sharpe Micrometer to your kit gives you a reliable tool for accurate measurements.

The care and skill used in making the screw, fitting the spindle and graduating the thimble and sleeve are features which make every Brown & Sharpe

Micrometer an accurate, dependable tool.

Micrometers of especial interest to the garage mechanic are the No. 55 which measures all pistons from 2" to 6" by thousandths of an inch and the No. 270 Tubular Inside Micrometers for accurately gauging cylinder bores.

Are you acquainted with the No. 607 Micrometer Depth Gauge and other "New Tools by Brown & Sharpe", for every close limit job?

Write today for Catalog No. 28

BROWN & SHARPE MFG. CO.
Providence, R. I., U. S. A.

BROWN & SHARPE TOOLS

Forming Equipment by Brown & Sharpe

Formers NOW for BIGGER BUSINESS

135

BROWN & SHARPE MFG. CO.
Providence, R. I., U. S. A.

COLD PIPE BENDERS

Standard of the World
HAND and MOTOR OPERATED

What it does for you is bend pipe and tubing in any size and shape without the use of heat.

AMERICAN PIPE BENDING MACHINE CO.
Baltimore, Md.

COMBINED GRINDER \$25.00
RUFFER

1/4 h. p. A. C. Motor 6 in. Norton Wheel and 7 in. Cotton Buff

Motor Alone \$13.50

1/4 h. p. 110 vol. A. C. 60 cycle.
1750 RPM

The above low prices will be withdrawn May 1st after which higher prices will be made necessary by the marked increase in the cost of materials.

Send cash with order. Our money-back guarantee protects you.

Write for Bulletins describing these and other sizes.

NORTHWESTERN ELECTRIC CO.
408 So. Hoyne Ave., Chicago, Ill.

"Old Town Canoe"

The Call of QUIET WATER

A QUIET stream is a wonderful place to loaf—paddle a canoe. Just use along. The "Old Town" glides forward at the slightest pressure of the paddle. The water murmurs a mild protest as it ripples off the bow.

An "Old Town" is the finest of canoes. It is easy to paddle—exceptionally strong and light and steady. It will last you for years. And it is the lowest-priced canoe you can buy. \$14 up from dealer or factory.

The new 1923 catalog shows all models in full colors. Write for one to-day. It is free.

OLD TOWN CANOE CO.
1395 Main St., Old Town, Maine, U. S. A.

BETTER SHOP METHODS

Prize-Winners Reveal the Secrets of Their Success

JUST what sort of ability makes a man successful in shop work is revealed strikingly by the prize-winning contributions to the contest "How I Got that Better Job," recently conducted by the Shop Methods Department of POPULAR SCIENCE MONTHLY.

The prizes have been awarded as follows:

FIRST PRIZE, \$30: J. Edgar Mitchell, Huntsville, Ala.

SECOND PRIZE, \$20: James Ellis, Memphis, Tenn.

THIRD PRIZE, \$10: L. Malkovsky, New York City.

The contributions of these three men give, with extraordinary vividness, the methods by which they have increased their earning capacity, and worked up from the bottom to mechanical positions of responsibility. Their stories will be published next month.

Two other articles submitted in the contest will also be published whenever space permits. These are in many respects the most exceptional of all the contributions, but in each case the writer, who is well known in shop circles, asked that his name should not be published. It was therefore impossible to award prizes, under the terms of the contest, to these men yet their messages are too helpful and inspiring to be ignored.

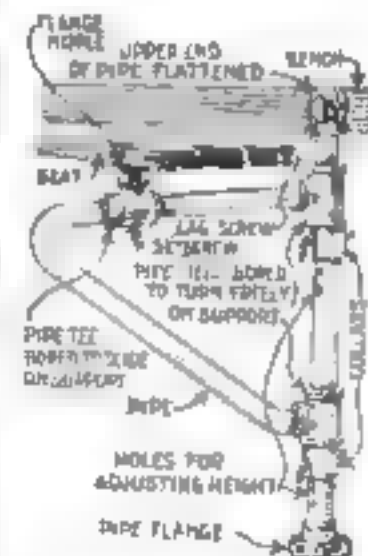
This series of articles points the way to success for every mechanic, and represents the most successful step yet taken by this department to promote the cause of better shop methods.

Adjustable Stool for Shop Bench

A SHOPMADE bench stool that is adjustable to both height and distance from the bench is a special feature of the shop equipment at a machine shop of the Washington Navy Yard. The shop foreman found that increased production resulted in providing stools for mechanics

engaged in the lighter tasks of fitting and gaging.

A pipe flange supports a vertical pipe, which is flattened at the other end and lagscrewed to the bench. The seat support, made as shown, slides up and down the standard, and is held at the height desired by means of two collars with pins. The bearings of the seat bracket are simply pipe tee connections drilled out so as to slide and turn freely on the standard.



The stool turns under the bench when not in use.

The wooden seat is 12 in. in diameter and fitted with a flange, pipe nipple, tee, and setscrew. This allows the seat to be adjusted in and out, and it can be swung under the bench when there is no necessity for using it. G. A.

BETTER SHOP METHODS

Heat Properly Applied Reduces the Pipe in Cast Ingots

BY USING "hot top" rings, like those shown at A, as well as heating the inside of the molds before pouring the ingots, and heating them outside before, during, and after pouring, the defects of pipe in chromal (which is 80 per cent nickel and 20 per cent chromium) can be reduced one third. Only 10 per cent of each ingot needs be cropped off to get rid of the pipe, whereas ordinarily it is necessary to crop 30 per cent from the top. This is a saving of 20 per cent in the length of the ingot. The apparatus used is just as applicable for other metals or alloys, as chromal has practically the same shrinkage as steel, brass, or bronze.

The molds shown are for casting ingots 4 in. square and 2 ft. long. The hot ring A is an iron casting 8 in. in diameter and



The molds are well heated before pouring and kept hot during and after pouring

8 in. long, lined with molding sand and baked on top of the induction electric furnace in which the metal is melted. The insides of the molds are made as hot as possible by locating the gas burner B directly over them and shooting gas flames into them. Pipes C are then placed so that the gas flames will heat the outside of the mold.

While this is going on, the pouring ladle is filled and skimmed. The gas burners B are then removed and the hot ring is placed in position. The pouring funnel D is placed on top of the ring and the molten metal is poured. The burners C keep the outside of the molds hot until the ingots are comparatively cold. The pouring funnel D is molded from graphite and baked on top of the melting furnace.

At E and F are shown small blowers directly driven by ½-hp. motors, which mix the gas with air and give it a blast that drives gas flames down into the ladles to dry out their linings. Pipe G delivers one of the flame blasts.—E. F. LAKE, Detroit, Mich.

Cracks in Castings

TO PREVENT a crack in a casting from extending, the usual practice is to drill a hole at each end, but this frequently fails because the holes were not drilled in the proper place.

In order to determine exactly how long a crack is, cover the surface with a mixture of equal parts of kerosene and oil. Allow it to stand for a time, wipe the surface clean, and brush on the white-washing mixture used when laying off lines. The crack will show up as a clearly defined yellow streak.—A. C.



How Men Get Those clean, white teeth you see

Not long ago beautiful teeth were seen less often than now. People did not like to show them. Now everywhere you see teeth that shine.

The reason lies in a new teeth-clearing method. Make this free test and see what it does for you.

was perfected, based on modern research. Those two great film combatants were embodied in it.

The name of that tooth paste is Pepsodent. Leading dentists the world over now advise it. Millions of people in some fifty nations use it every day.

That cloudy film

Your teeth are coated with a viscous film. You can feel it with your tongue. It clings to teeth, gets between the teeth and stays.

Food stains, etc. discolor it. Then it forms dingy coats. Tartar is based on film. Those coated teeth don't shine.

Film also holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay. Germs breed by millions in it, and they cause many troubles.

Kills acids, too

Pepsodent also multiplies the alkalinity of the saliva. That is there to neutralize mouth acids, the cause of tooth decay.

It multiplies the starch digestant in the saliva. That is there to digest starch deposits on teeth which may otherwise ferment and form acids.

Thus Pepsodent gives manifold effect to these great tooth-protecting agents in the mouth.

Avoid Harmful Grit

Pepsodent curdles the film and removes it without harmful scouring. Its polishing agent is far softer than enamel. Never use a film combatant which contains harsh grit.

Very few escaped

Under old methods few escaped these troubles. So dental science searched for ways to fight that film. Two ways were found. One acts to curdle film, one to remove it, and without any harmful scouring.

Able authorities proved these methods effective. Then a new-type tooth paste

Learn what it means to you. Send the coupon for a 10-Day Tube. Note how clean the teeth feel after using. Mark the absence of the viscous film. See how teeth whiten as the film-coats disappear.

You will see and feel enough to convince you that you should always brush teeth in this way. Cut out the coupon now.

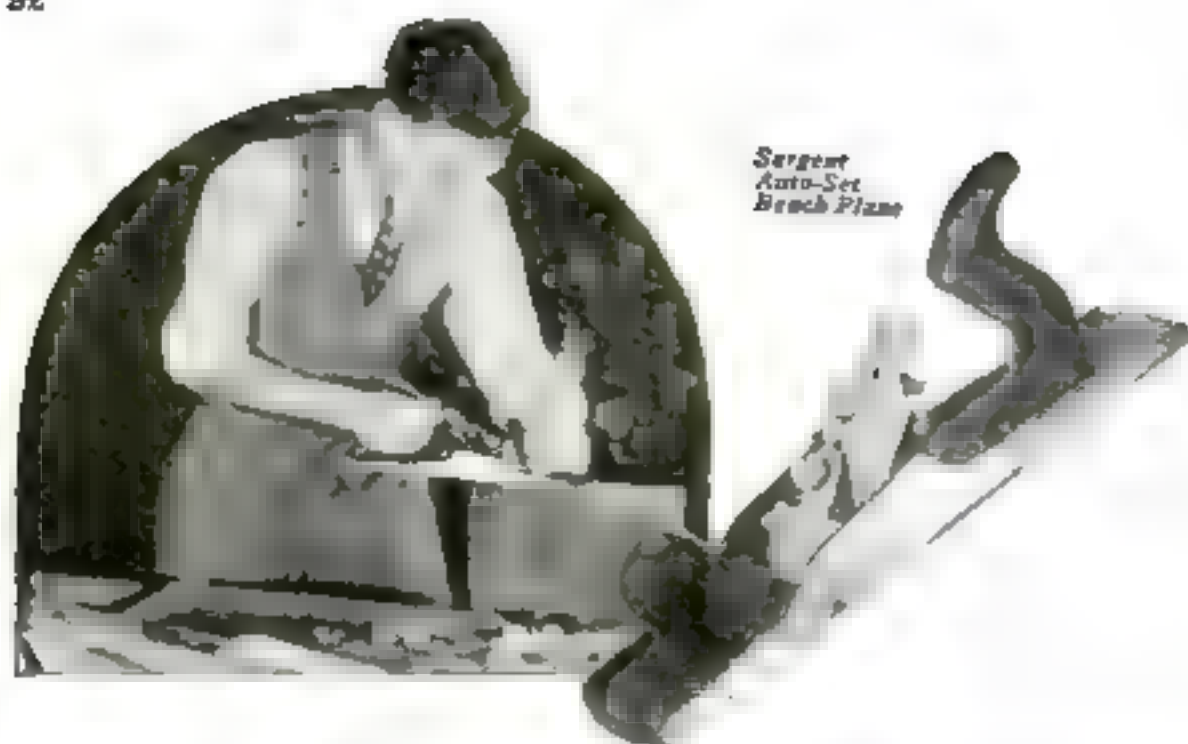
Pepsodent
REG. U. S. PAT. OFF.

The New-Day Dentifrice

A scientific film combatant, which whitens, cleans and protects the teeth without the use of harmful grit. Now advised by leading dentists the world over.

10-Day Tube Free 1041

THE PEPSODENT COMPANY,
Dept. 240, 1104 S. Wabash Ave., Chicago, Ill.
Mail 10-day tube of Pepsodent to

Sargent
Auto-Set
Bench Plane

*This plane always makes shavings—
even across the grain!*

MANY a plane will cut smoothly with the grain and when the grain is straight and true. The test comes when you push the plane across the grain.

But the Sargent Auto-Set Bench Plane always makes crisp shavings, always cuts clean and true—even across the grain. Its cutter of chromium alloy steel never chatters, so rigid is the mechanism. And it holds a keen edge through the most difficult work. You may remove it, when sharpening is necessary, and replace it without disturbing the adjustments.

For the finishing touches to your craftsmanship, use the Pocket Plane and the Steel Block Plane. They are handy, small in size and as dependable as all Sargent tools.

See these planes at hardware dealers everywhere.

Full information is contained in the Sargent Book of Planes, which will be sent free upon request.

SARGENT & COMPANY
50 Water Street New Haven, Conn.

SARGENT
Tools & Hardware

Sargent
Steel Block
PlaneSargent
Pocket Plane

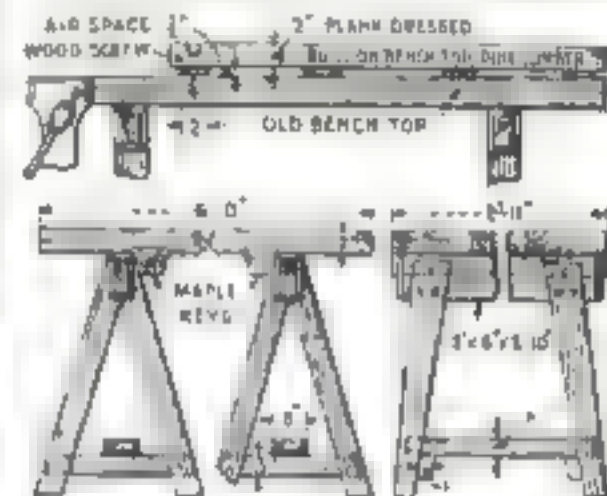
BETTER SHOP METHODS

How a Pattern Maker Can Keep His Bench Top True

THE machinist is supplied with angle plates, surface plates, faceplates and all sorts of work-supporting and work-holding fixtures. The pattern maker is usually fortunate if he can find enough clearance at the end of his bench on which to build, square up, and measure his patterns.

If his bench is at all warped or twisted, it will not serve properly for this purpose.

Fastening a pine board on the top of the bench is a practice common among pattern makers and the board can be dressed when required. This, however, is not a good plan, because the air circulates only on the exposed surface of the board. Today the board is dressed by hand straight and true; tomorrow or the next day it is twisted and



Two types of bench tops that have the advantage of being readily trued up for accurate work

hollow in the center. The change is perhaps not noticed until a mistake has been made in a pattern.

The best bench top that I know of is made as shown. It is a pine plank 18 in. wide, 6 ft. long, and 1½ in. thick when dressed. Between it and the bench top are maple strips ½ by 2 by 18 in. spaced not more than 12 in. apart. Wider spacing will allow a spring in the plank when patterns are being nailed. The plank is fastened in place with screws and given a final dressing. A bench fitted up in this way will remain straight and true.

Another fine pattern maker's table consists of a pair of wooden horses built extra heavy and strong. The tops of the cream rails are level and parallel. The top is made of three pieces of 2-in. pine dressed flat and true and held loosely in position by dowel pins that are tight in one plank and loose in its companion. A maple key is driven into dovetails cut in the planks, so that when the three planks are assembled and squarely fastened together, the top surface is flat, true, and out of winding.

When the top requires redressing, all that is necessary is to drive out the maple keys, pass the planks one at a time through the planer, and assemble them again, all of which can be done with very little labor and in the shortest possible time.

One of the important details in connection with the redressing of the table top is to do the work just before the knives in the planer are taken out to be changed or sharpened.

Seven years ago I made up a bench and worktable as described and they are still giving good service.—M. E. DUGGAN, Kenosha, Wis.

CHARCOAL rubbed on a partly worn file will make it bite better

DIAMONDS
Here at 60%
of Market Price

Why Pay Full Prices
Send for Latest List

JOSEPH & SONS, 450 Fifth Ave., New York City

AGENTS \$6 a Day

Should be made every morning by cupping the nose and throat with a special preparation. Over 100,000 bottles of this preparation have been sold. It is a powerful disinfectant and kills all bacteria. It is a powerful disinfectant and kills all bacteria. It is a powerful disinfectant and kills all bacteria.



FREE

Prophy-lactic
Tooth Brush

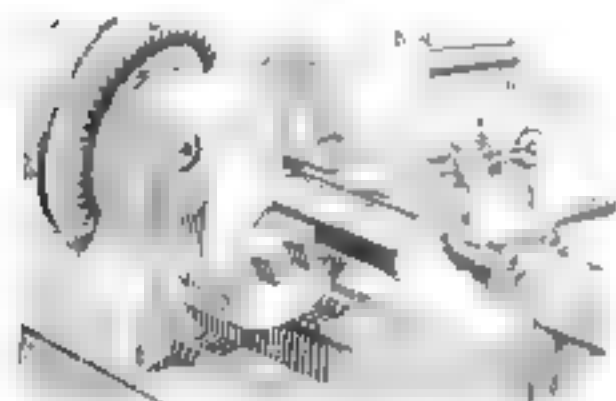
A clean tooth never decays—the Prophy-lactic keeps teeth clean

BETTER SHOP METHODS

Three-Jaw Chuck Used for Boring Eccentric Holes

FOLLOWING customary machine shop practice, I have always used a four-jaw chuck for holding work to be bored eccentrically, until I discovered that it was very easy to do the same work with a three-jaw chuck.

The work being laid out as shown, bring up the tailstock center and open the jaws



By using a plug of the proper diameter, work can speedily be chucked eccentrically.

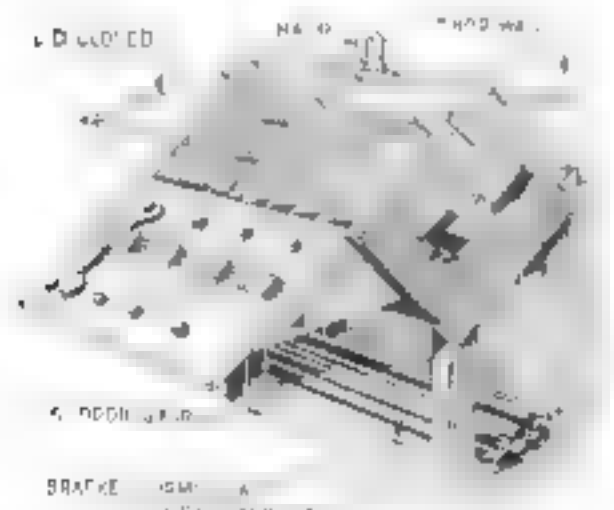
of the chuck so that the work drops down between the two lower jaws until the center punch mark of the hole to be drilled comes in line with the center of the tailstock.

Then measure the distance from the top of the work to jaw A, place a plug, B, of a diameter equal to that distance, between jaw A and the work. This will automatically serve to clamp the work in the correct position and is accurate enough for any job not important enough to require a center tester for truing up the work.—S. L. ROBERTS.

Tools Are Readily Accessible in Unique Inclined Toolchest

SINCE the speed with which a job is completed depends considerably on the accessibility of the tools, a well arranged toolbox is certain to save time and labor. The box illustrated which is used by an automobile service station with a reputation for speed and thoroughness in making repairs, is supported on an inclined rack.

One advantage is that practically every tool in the box is visible across the width



Kept in this chest, tools and supplies are visible and can be selected quickly.

of the shop. Another is that a special place is provided for each tool, so that the absence of any one is noticeable. This reduces the loss of tools. In addition, the box has small compartments for split sockets, taper pins, lock washers, screws, and nuts.—F. L. U.

I Pay Your Railroad FARE



CHICAGO
The electrical center of the world

B. W. Cooke, Pres.

COME TO CHICAGO—the Electrical Center of the World—I pay your railroad fare from any place in the United States. Grasp this opportunity to see the country at my expense. Don't stick in one spot—travel—get experience. Come to Coyne—learn electricity in 3 months. Fit yourself for a big paying job. The largest electrical school in the country specializing in electrical instruction only.

Learn Electricity In 3 Months

Get a complete training so you can make big money as Power Plant Operator, Superintendent, Telephone man, Construction worker, auto, truck or tractor electrician, battery man, radio expert, or you can go into business for yourself as electrical contractor, dealer, auto ignition or battery expert and make from \$3,000 to \$20,000 a year. Hundreds of our graduates today are making big money and you can do the same if you grasp this opportunity—act now.

Great Shops of Coyne

No books or useless theory. You are trained on \$100,000 worth of electrical equipment. Everything from door bells to power plants. You work on motors, generators, house-wiring, autos, batteries, radio, switch-boards, power plants—everything to make you an expert ready to step right into a position paying from \$45 to \$100 a week.

Radio Course Free. We include the following free with the regular course:
(1) A complete course in auto, truck and tractor electricity and storage batteries. Greatest outlay of auto, electrical and battery equipment in the country.
(2) Course in Radio—the marvel of the age. Constructing, installing and operating. Build your own wireless telephone set.
(3) Life membership in the Coyne school. Stay as long as you wish and return for further training at any time in the future.

Earn While You Learn! We help students to secure jobs to earn a good part of their expenses while studying.



Student working a Motor

SEND COUPON

Don't delay a minute! Send this coupon right now for our big free catalog and full particulars of Free Railroad Fare offer. Remember this special offer is limited to act now.

COYNE
Endorsed by Electrical Industry
1364-1316 W. Harrison St., Dept. 13-45, Chicago

B. W. Cooke, Pres.
COYNE ELECTRICAL SCHOOL
1364-1316 W. Harrison St. Dept. 13-45, Chicago

Dear Sir: Please send me free your big catalog and full particulars of your special offer of Free Railroad Fare and two extra courses.

Name _____

Address _____

\$1.00 A SUIT



5 Big HANES Features

- 1 Hanes large, roomy armholes lapd instead of turned under. Can't curl or rip—but a friction-free surface that really wears.
- 2 Hanes walking belt guaranteed 3 thread elastic stitching instead of single thread, gives more elasticity and greater strength. Specially sewed to prevent tears and rips.
- 3 Hanes closed crotch is cut and stitched in a special way that really keeps it closed. That means added hot weather comfort.
- 4 Hanes crotch lap buttons sewed on the seam. Won't come off & thickness of material insures uniformity. No patch guard.
- 5 Hanes wide, full length knee cut in so to give greatest freedom without blocking or creeping up the leg.



Full Cut
ATHLETIC UNION SUITS

You've got it all
in "HANES" at \$1.00

WHAT we put into "Hanes" Athletic Union Suits for \$1.00 cannot be duplicated anywhere near the price! As manufacturers we know this; you will prove it when you personally understand the comfort, workmanship, material and service that "Hanes" hands out!

Check up "Hanes" in comparison! We tell you "Hanes" is made to meet the world! Examine every detail from the quality of the mainwork down to the four thicknesses of material that holds the crotch lap button! "Hanes" is generously full cut and allows for the hardest work and play. Every strain-point is reinforced!

Put the youngsters in "Hanes" Athletic Union Suits—they give such wonderful service. 2 to 16 years, in sizes 20 to 34.

HANES GUARANTEE: We guarantee Hanes Underwear absolutely—every thread, stitch and button. We guarantee to return your money or give you a new garment if any seam breaks.

If your dealer can't fit you with
"Hanes" Underwear, write us immediately.

P. H. HANES KNITTING CO., Winston-Salem, N. C.
New York Office, 366 Broadway

Next Winter Wear Hanes Winter Underwear

Kellogg Radio Equipment for Better Results



No. 501

The Kellogg rheostat is of simple design, having but one moving part.

It is so arranged that a maximum contact surface is provided, making perfect contact. To assure perfect current to the most critical tube, the rheostat operates on the half turn of the resistance element.

No. 501..... Each \$1.50

Ask your dealer for Kellogg Radio Equipment

Use, Is the Test

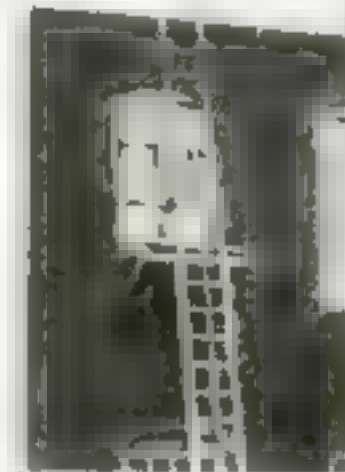
KELLOGG SWITCHBOARD & SUPPLY COMPANY

CHICAGO

BETTER SHOP METHODS

Ladder Scaffold Simplifies Work of Painting Factory Windows

IN PAINTING the windows of a two-story mill, we use the ladder platform illustrated. The ease and speed with which this can be moved is remarkable and has repaid the cost of construction many times.



The platform is moved from window to window.

The main frame of the platform is made of two pieces, one by 3 in. by 4 ft., and one piece 2 by 4 by 4 ft. 6 in. The platform is 18 in. wide and the cross member, which extends 8 in. on each side, is held to the ladder by 1/2-in. hook bolts.

A rope fastened over a small pulley in the top rung of the ladder raises and holds the platform when the ladder is moved from one window to another—DONALD C. HARDIE, Avoca, Pa.

How to Color Steel Blue

POLISHED steel articles, if smooth and clean, may be given a blue finish by placing them in heated charcoal.

The charcoal is powdered and placed in a box of steel or iron plate. The steel being colored must be taken out from time to time and dusted with finely powdered whiting. When the desired shade of blue is reached, the piece is removed and allowed to cool; it is then cleaned and oiled.

When the danger of warping through heat must be avoided, the steel is first cleaned thoroughly and then covered with a solution of 10 parts water to 1 part nitric acid. After it has turned a light shade, wash it thoroughly with warm water, using a soft cloth; then wipe it dry. Finally, rub it well with linseed oil.—F. H. SWEET, Waynesboro, Va.

Milling Flutes with Two Cutters

IN CUTTING flutes on a reamer or on any cylindrical surface, the usual practice is to machine one flute at a time. By



This use of two cutters for fluting is much quicker than machining one flute at a time.

rigging up a milling machine as illustrated, the time can be cut nearly in two.

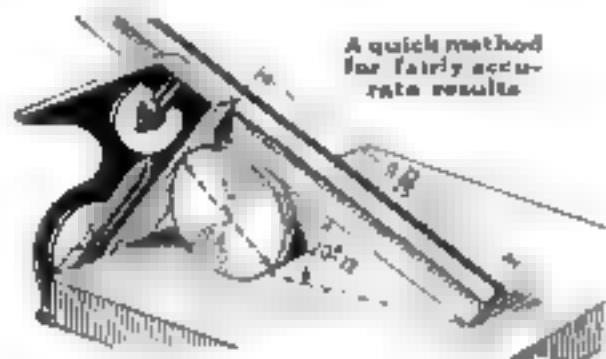
A regular dividing head is used and two cutters are placed on the main spindle of the machine, so spaced as to cut out both sides at the same time. This is a simple arrangement, but it has been a money-saver for the firm using it.—J. H. MOORE, Toronto, Can.

BETTER SHOP METHODS

Setting Angles with Combination Square and Disk

IN SETTING up angles where absolutely accurate results are not needed, an ordinary combination square is often used with a disk of known diameter.

The head of the square is set on a point found by multiplying the radius of the disk by the cotangent of half the angle wanted and then adding to this the radius of the disk. The cotangents of the degrees and minutes are in all ordinary machinery handbooks. Any inaccuracy of this pro-



A quick method for fairly accurate results

cedure comes from setting the square head at the nearest scale fraction and is small enough to make the method practical where the precise accuracy of the sine bar is not needed.

For example, if the angle wanted is 20 degrees, 12 minutes, and a 3-in. disk is at hand, the only question to be solved is where to set the head of the square on the blade. If the required angle is 10 degrees, 6 minutes, the cotangent of which is 8.61397, multiplying this by the radius of the disk or 1.5 gives 8.420955. To this is added the radius of the disk, or 1.5, giving 9.920 or 9 23/25 in. This is the distance at which to set the head of the square.—HENRY S. LARABY, New Haven, Conn.

Lanolin Conquers Skin Troubles Common to Metal Workers

LANOLIN, or equal parts of lanolin and castor oil, rubbed on the hands and forearms, will prevent the more or less common skin affections known as "oil ache" that result from constant contact in the shop with cutting oils and lubricating compounds.

The United States Public Health Service, which has made an investigation of the causes and prevention of such skin troubles, reports that in plants where the lanolin preventive was used, all cases of this type of skin trouble disappeared in a short time and that no new cases occurred.

It is recommended that each workman before starting his day's work, wash his hands and forearms thoroughly with warm water, using a sandblast and liquid soap preparation to assist the cleansing process. The lanolin, or lanolin and castor oil, should then be rubbed well into the skin. At noon, before luncheon, it is urged that the workman wash again with warm water and soap, and upon returning to work repeat the washing and application of lanolin.

The importance of some such routine is emphasized by the fact that about 27 per cent of the workers examined were found to be suffering from the characteristic skin troubles of metal workers.

Vigorous washing and the use of lotions at the end of the day were found not to be so effective in the end as the preventive measures.—C. H. G.



If the subscriber paid direct

Suppose that every Monday morning all the people who have a hand in furnishing your telephone service came to your door for your share of their pay. From the telephone company itself, would come operators, supervisors, chief operators, wire chiefs, linemen, repairmen, inspectors, installers, cable spicers, test-boardmen, draftsmen, engineers, scientists, executives, bookkeepers, commercial representatives, stenographers, clerks, conduit men and many others, who daily serve your telephone requirements, unseen by you.

There would be tax collectors to take your share of national, state and municipal taxes, amounting to over forty million dollars. There would be men and women coming for a fair return on their money invested in telephone stocks and bonds—money

which has made the service possible. Then there are the people who produce the raw materials, the supplies and manufactured articles required for telephone service.

They would include hundreds of thousands of workers in mines, smelters, steel mills, lumber camps, farms, wire mills, foundries, machine shops, rubber works, paint factories, cotton, silk and paper mills, rope works, glass works, tool works, and scores of other industries.

When you pay your telephone bill, the money is distributed by the company to the long line of people who have furnished something necessary for your service. The Bell System spares no effort to make your service the best and cheapest in the world, and every dollar it receives is utilized to that end.



"BELL SYSTEM"
AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES
One Policy, One System, Universal Service, and all directed toward Better Service

SEND FOR FREE BOOK

"FISHING—WHAT BAITS AND WHEN"

Every fisherman should have it. Interesting and instructive. Tells what baits to use for every kind of fishing. Postal form on back.

SOUTH BEND BAIT CO.
14230 Dep. St., South Bend, Ind.



\$25 A DAY
Selling Shirts

Large shirt manufacturer wants agents to sell complete line of shirts, pajamas, and nighties direct to wearer. Advertisements—exclusive patterns—easy to sell. No experience or capital required. Entirely new proposition. Write for free samples.

Madison Shirt Co., 208 Broadway, N.Y.C.

Better Work and More of It

These are the results obtained to an amazing degree by hundreds of users of

Boice Junior Bench Saw

A wonderful practical, compact, all metal machine designed for accurate and speedy sawing, ripping, grooving, etc. Cuts 12" stock. Dadoes 3/4" deep and 3/8" wide. Driven by 1/2 or 3/4 h.p. motor. Special saws cut type-metal, bakelite, brass, etc. Portable. Attaches to lamp socket.

Write for descriptive literature on the Junior Bench Saw. 14" Junior 14" Bench Band Saw. Bench Drills. Motors and Taper Bench Saws.

W. B. & J. E. Boice, Dep. P.O. 114 25d St., Toledo, Ohio





"Red Devil" Phone made in 1938 ships—one for every road. Known and used the world over. Style No. 1014—6 1/2 inch plenum case. \$1.00

The
"Red Devil" Wrench Set
Fits Every Nut Right



A REALLY fine wrench set with which you can tackle the toughest jobs and save time.

"Red Devil" open-end "S" wrenches are handier than a monkey wrench. They fit every bolt and nut right and hold fast. Openings will not spread. They are thin—just the tools you need for working in hard-to-get-at places. Forged from open hearth steel, heat-treated for strength.

Each set consists of five wrenches, with sizes of openings ranging from 7/16 to 1 inch. "Red Devil" Wrench Set No. 92, price 50c at hardware stores or from our factory.

For those who prefer to work with a straight wrench, we have also this pattern in the above type of wrench, five wrenches to a set, 50c a set, at hardware dealers. If not in stock, send dealer's name and order direct.

Mechanic's tool outfit free.

SMITH & HEMENWAY CO., Inc.
Manufacturers of "Red Devil" Tools
264 Broadway New York, N. Y.

"Red Devil" Glass Cutters - the glass' standard tool of the world. It's all in the work! Made in U.S.A. No. 514 shown here. 20¢

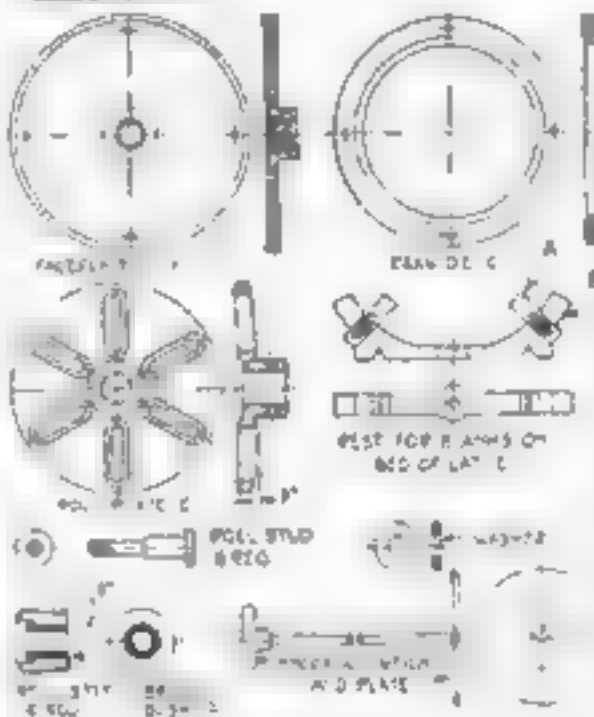
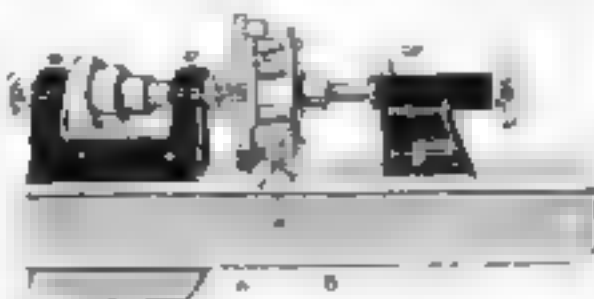
BETTER SHOP METHODS

Inexpensive Fixture on Wood Lathe Used for Drawing Shells

WHEN a few shallow shells have to be drawn, the necessity for making expensive tools can often be avoided by the simple method illustrated. This will serve for shells up to $\frac{1}{4}$ in. deep.

Any ordinary wood turning lathe can be used if the spindle and bed are true. As large a faceplate as the lathe will take is recessed $\frac{1}{4}$ or $3/16$ in. deep, as shown, to fit the largest die required. The die itself is cast iron.

A cast iron bar, fitted and bolted to the bathways, has two fingers set even with



How the shell drawing attachment is used
up, and details of the parts

the edge of the draw die, so that the blanks can rest on them.

A roll plate is made for the tail spindle. The six rolls are so arranged on studs that they can be moved in or out to draw shells of the size needed. The rolls and the roll plate have an 8-degree angle, as indicated, to prevent the rolls from binding.

After the blanks are cut or slit, the dies are placed on the fingers, the tailstock spindle is moved, and the rolls draw the blank into the die. The completed work is driven out by means of a $\frac{1}{2}$ -in. thick circular plate, a trifle smaller in diameter than the shell itself, the center of which is riveted to a bar that passes through the hollow headstock spindle. Either a weight or a cross handle can be used to give force to the knockout blow. The shell comes out on the forming rolls as the tail spindle is withdrawn.—S. C. H.

Keeping Oilstones in Condition

FOR cleaning an oilstone that is glazed or gummy, use ammoniac or gasoline on a piece of cotton waste. If the stone is in very bad condition, scour it with emery powder or sandpaper.

To true up the surface, rub it on a flat piece of cast iron with loose emery and water.—S. J.



**SHOWS THE
WAY FOR
1/4 OF A MILE**

YOU need this reliable electric blower around the home, in the garage, for you working up a job. If you sleep or camp you will find this a true essential.

[illegible]

To find anything on the high shelf - or 100
to the left - under your automobile
and for more information on what you will
find call ARNOLD FLECK & ARNOLD
Industries.

**Operates on two ordinary dry cells,
giving it exceptionally long life.**

The 4-lb. can is made of absolutely water-proof moistureproof and gasproof, and it will last a lifetime. (Order one today.)

Complete with batteries for	59.40
12m batteries	7.16

CHARLES R. ABLETT CO.
TAMP SPECIALISTS
130-301 Fulton St. New York, N. Y.

Deaf Can Hear Says Science

New Invention Aids Thousands

There's good news for all who suffer from deafness. The Dictograph Products Corporation announces the perfection of a remarkable device which has enabled thousands of deaf persons to hear as well as ever. The makers of this wonderful device say it is too much to expect you to believe this so they are going to give you a chance to try it at home. They offer to send it by prepaid parcel post on a ten-day free trial. They cannot send it C. O. D.—they require no deposit—there is no obligation.

They send it entirely at their own expense and risk. They are making this extraordinary offer well knowing that the usage of this little instrument will be to increase and ~~bring~~ get the user that the chances of his being returned are very slight. Those sands have a really accepted this offer and report most gratifying results.

[illegible]

You, Too, Can Play the HAWAIIAN GUITAR
Just as the Natives Do

**Only Four Minutes Which You Don't or Quick
ly You Play Real Music Your First Lesson
Reveals Musical Knowledge as easy as 1
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100
101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120
121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140
141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160
161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180
181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200
201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220
221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240
241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260
261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280
281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300
301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320
321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340
341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360
361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380
381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400
401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420
421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440
441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460
461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480
481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500
501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520
521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540
541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560
561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580
581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600
601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620
621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640
641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660
661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680
681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700
701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720
721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740
741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760
761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780
781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800
801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820
821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840
841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860
861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880
881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900
901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920
921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940
941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960
961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980
981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000
1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020
1021 1022 1023 10**

OUR METHOD SIMPLE AND POSITIVE

FREE a beautiful Newman Guller 44" x 60" x 12" glass display island in place of your Stanton's male! This wildlife sculpture is a great conversation piece for your Guller's and home. And mail order!

First Newman Conservatory of Music, Inc., c/o New York City 25 45 0000 1st Avenue, New York 10003

DRIVE This Beautiful RACEABOUT
INSTEAD OF YOUR OLD FORD



First of Shell's Most
Radiant. Cholesterol
free colors. Stand
for complete Caring
of Auto Bodies. Ac
cessories and Speed
Pump Equipment.
Dinner Room, Electric

AMERICAN TOP AND BODY CO., Lee St., Detroit, Ind.

BETTER SHOP METHODS

Step Block Serves as Gage for Planing Duplicate Pieces

TO SAVE time in shaping a number of pieces, shown at A, I prepared a gage block, B, which was fastened to the top of the vise. Each surface, 1, 2, and 3, repre-



The fixed gage prevents errors and insures uniformity in planing and shaping.

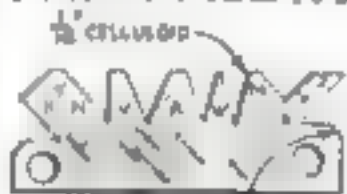
sented a height corresponding to a finished surface of the work, so that I could set my tool without taking time to make measurements.—J. M.

Celluloid Templet Saves Time in Lettering Drawings

WHEN the titles of drawings have to be drawn carefully in a strictly mechanical style, considerable time can be saved by using a simple templet cut from 1/16-in. celluloid.

The templet provides the correct angle for the various letters and insures neatness and uniformity of style. It serves for drawing letters from 3/4 in. high up to the limits of its capacity. Two guide lines are drawn for each line of lettering, and the base of the templet is rested on the top edge of the T-square and slid along like a triangle.—F. B. V.

KAWNMZYX

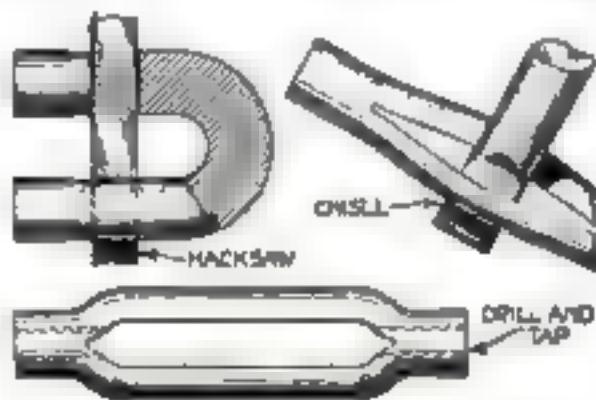


FORMING CORNERS OF LETTERS

A templet and the letters made with it

Shopmade Turnbuckle Saves Time in Emergency Repairs

WHEN a turnbuckle has to be replaced quickly and one of the necessary size is not at hand, it is possible to make a simple and satisfactory substitute from cold rolled steel. A piece of the requisite



Three steps in making a substitute for a stock turnbuckle

length and diameter is doubled over after heating and notched with a hacksaw, as shown. After it has been reheated and straightened, the slot is widened to its extremity with a cold chisel and the ends are tapped with right- and left-hand threads.—G. A. LUERS.



This heavy-duty pen is a feature of the New Corona. It is made of the finest materials and is designed for long life.

See the New Corona first!

BEFORE you buy your portable typewriter, step into a Corona Store and see how many points of superiority the New Corona has over any previous type of portable.

Speed: The Standard Portable Keyboard, with right and left shift keys, cannot be surpassed for simplicity and swiftness of operation. Just compare it with the more complicated keyboards which have preceded it.

Convenience: Everything you would expect in a large machine, even to the automatic ribbon reverse, the two color ribbon, the extra wide carriage (10 inch), and the standard front-stroke type bar. In Corona you have a machine whose writing is completely visible—from the first word to the last. Foreign language or technical keyboards at no extra cost.

Strength: Corona is built to stand rough usage—and while Coronas have been dropped from every kind of conveyance, including an airplane, there is no record of a Corona frame ever having been broken. One reason for Corona's unusual sturdiness and wearing quality is the fact that it has fewer parts than other portables. Therefore its mechanism can be of heavier construction without sacrificing portability.

Reputation: Corona is the pioneer of portable typewriters. Among its owners and life-time friends are many of the most famous men and women of our time. More Coronas are in use today than all other makes of portables combined.

Look for "Corona" in your phone book, or write us for our new illustrated folder.

Price \$50, with case. In Canada \$69

CORONA TYPEWRITER CO., INC.

112 Main St., Groton, N. Y. 129 W. 42nd St., New York

72 E. Randolph St., Chicago

New Motorboats from Old

by Capt. E. Armitage McCann



THIS is the first of three remarkable articles by Captain McCann, a nationally recognized expert on boating. He tells how to buy an old motorboat cheap and remodel it into a stanch and serviceable craft. Realizing that cost stands between the average man and a motorboat, we asked him to study the subject from all angles and work out ways in which the home worker can save himself hundreds of dollars on the cost of his boat. The result is this exceptionally practical and valuable series on repairing motorboats.—THE EDITOR

IF YOU cannot afford a new motorboat, why not buy some old boat that the owner does not think worth repairing and remodel it? Often the private owner who has plenty of money, or the "boats for hire" owner, to whom time is money, has a boat that can be obtained cheap because it is in disrepair, but you can perhaps make it seaworthy in your leisure time. The work will not only save money, but it will be interesting and entertaining, if gone at in the right way.

The skill necessary to build a boat from the keel up is not required, but you should have a good set of tools and be handy in using them. And, what is more important, you will need a large bump of the contriving faculty combined with perseverance and common sense. The materials will cost money, of course, but the expenditures will not have to be made all at once.

Old boats are to be found along any waterfront, in sheds, on slips, or just lying neglected out in the open. When the owner is discovered—sometimes quite a job—these may be had surprisingly cheap,

down, or the paint peeling off. What we have to try for is the soundness of the wood; to look for places worm eaten or suffering from wet or dry rot, or where putty has been substituted for good wood.

The places that go first are where the planks join the stem, stern, or keel, so here, with the big blade of our pocket-knife, we will scrape off some of the paint, and dig in the small blade to test for rottenness. If the keel is in very bad condition, the whole boat must be rejected, because to replace that would be nearly as hard as building a

whole boat; but if it is bad only in places and then not too bad, we may be able to cut out the rotting or worm-eaten parts and replace with new wood.

The garboard stake or the plank joined to it is also frequently rotten and is the most difficult of the planks to replace, but it can be done. It may possibly be patched with a strengthening piece screwed to

the inside. Sometimes a small bad place, such as might be caused by running on a rock, can be repaired with a patch of thin sheet lead, with plenty of paint under it.

We must see if the stem is sound, as that also is difficult to replace, and if the planks are still fastened well to it. It is possible to reinforce the fastenings here by shaping a piece of oak so that it will make a new face from the edge of the stem to 1 in. or so over the plank edges. If done neatly, this will detract little from the appearance and nothing from the speed, but will bind the edges of the planks firmly in position. All should be well cleaned underneath and a



Although the stern shown in these photos looks bad, it can be renovated successfully by the amateur boat builder.



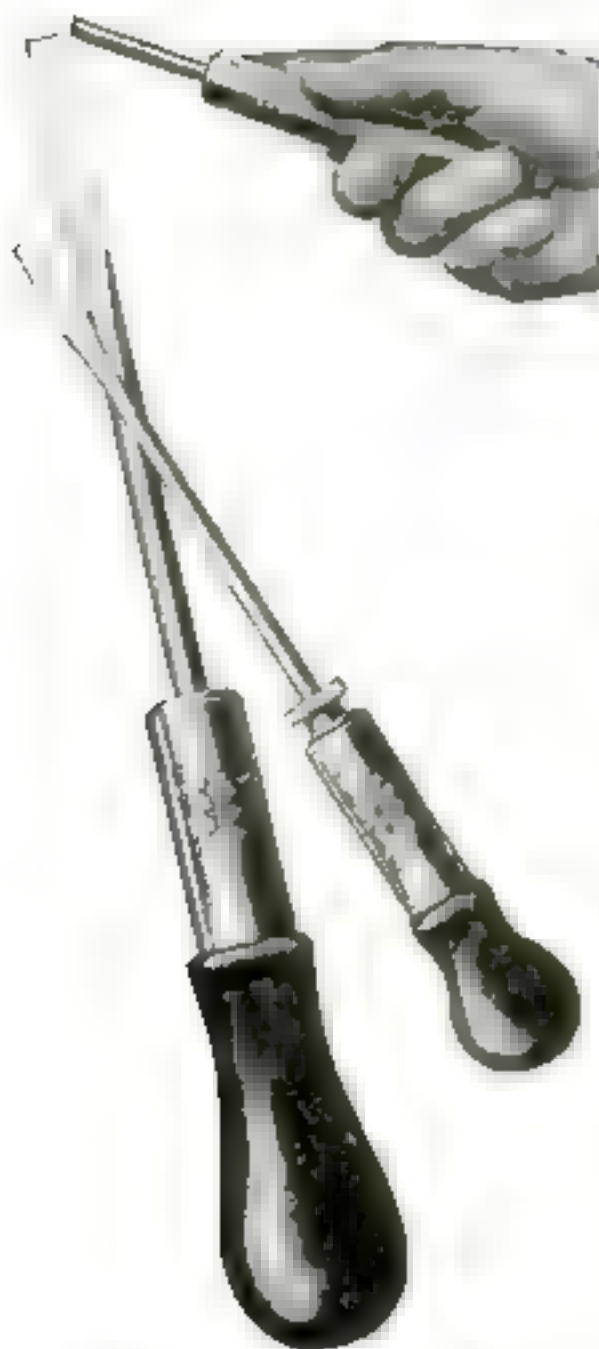
often for from \$50 to \$100 without a motor. So far as the motor is concerned, if you are not familiar with them, it is advisable before buying to obtain the opinion of some one who thoroughly understands them, preferably a professional boatman.

Having found a likely looking craft, you will have to decide if she is fit for repairing. It does not matter so much if she has a plank or so stove in, if her cabin is falling

strip of thick tarred paper placed between the old and new.

The sternpost and propeller shaft bushings must be examined, as this is another vulnerable part, where everything must be sound and rigid. Not much tinkering can be done on the outside here, but quite a lot of reinforcement can be accomplished with oak blocks on the inside.

Have a look where the ribs or frames are



Your wrist wasn't made with a Ratchet

That's why "YANKEE" Ratchet Screw-drivers were made—to save your muscles. No wearisome grip-and-let-go. Your first good grip need not be relaxed 'til screw is all the way home. It's like winding your watch.

"YANKEE" Ratchet Screw-drivers

No. 10 (Illustrated)—Specially tempered cast steel blades. 2, 3, 4, 5, 6, 8, 10 and 12 in. blades.

No. 11—Same as No. 10, except that ratchet shifter moves across barrel.

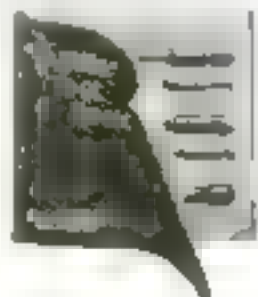
No. 15 (Illustrated)—Handy knurled thumb turn for starting small, wobbly screws. 2, 3, 4, 5, 6 and 8 in. blades.

Some other "Yankee" Tools

Spiral Screw-drivers Ratchet Chain Drills
Ratchet Hand Drills Automatic Push Drills
Ratchet Tap Wrenches Bench Vises

Tool Book Free

Illustrates and describes all the ingenious "Yankee" tools for saving time and labor. Write for it today.



NORTH BRAD MFG. CO. Philadelphia, U. S. A.

"YANKEE" TOOLS

Make Better Mechanics

THE HOME WORKSHOP

fastened to the keel; if they are good here, they will be good elsewhere as far as rottenness goes, but watch for split ribs or others that may have been broken by accident. If only a few are bad or split, they can be replaced, or, as this is inclined to shake the boat and leave holes in the planks, it is better to put the new ones alongside the old, leaving the latter there.

As for the shape to choose, one has to be guided by what one can get and the purpose for which it is to be used. If large parties for short cruises are anticipated, a roomy boat will be wanted, with plenty of cabin space. If speed is desired, the lines must be finer in bow and stern. The "compromise" or the V-shaped sterns are considered to be good both for behavior in a seaway and for speed. The fan shaped stern, as in the photograph, though good in a heavy sea, is inclined to drag and take from the speed.

Repairing the Stern

The problem of repairing will, of course, be different for every boat, but yet there will be many points of similarity. It is hoped that not all of the repairs given here will be necessary, but some of them probably will, and, of course, any of them will apply to a good boat that has met with an accident.

The boat selected has, as will be seen, met with very rough usage in the stern and her counter is in pieces, but the wood, except where broken and along the very edge, is sound. Now 1 ft. or 18 in. might be sawn right off the counter and a flat stern substituted, but this would be unsightly, as she is not built for a flat stern. We can, however, shorten up the stern about 6 in. without spoiling her lines.

First of all we will lift the coaming rim of the well, then raise the deck in the stern, some of which will have to be renewed anyhow. Take off the chafing moldings and cut back sheer strake (top plank) some

Continued on page 100

Coupon for Ordering Blueprints

Blueprint Service Dept.
Popular Science Monthly
225 West 39th St., New York

GENTLEMEN:

Send me the blueprint, or blueprints, I have checked below, for which I inclose.....cents in stamps or coin:

No.	Title	Price	
1.	Bewing Table	25c	<input type="checkbox"/>
2.	Smoking Cabinet	35c	<input type="checkbox"/>
3.	Book Trough End Table	25c	<input type="checkbox"/>
4.	10-ft. Monoplane Older	50c	<input type="checkbox"/>
5.	Kitchen Cabinet	25c	<input type="checkbox"/>
6.	V T Radio Receiving Set	25c	<input type="checkbox"/>
7.	Shaving Cabinet	35c	<input type="checkbox"/>
8.	Arbor with Gate and Seats	35c	<input type="checkbox"/>
9.	Porch Swing	35c	<input type="checkbox"/>
10.	Bench and Tilt-Top Table	25c	<input type="checkbox"/>
11.	Electric Washing Machine	25c	<input type="checkbox"/>
12.	Tea Wagon	25c	<input type="checkbox"/>
13.	Toy Train House and House	25c	<input type="checkbox"/>
14.	Home Workshop Bench	25c	<input type="checkbox"/>
15.	Inland Radio Cabinet	25c	<input type="checkbox"/>
16.	Cedar and Mahogany Chest	25c	<input type="checkbox"/>
17.	Telephone Table and Stool	25c	<input type="checkbox"/>
18.	Grandfather's Clock	25c	<input type="checkbox"/>
19.	Flat Top Desk	25c	<input type="checkbox"/>
20.	Colonial Writing Desk	25c	<input type="checkbox"/>
21.	Girl's Cabinet and Desk	25c	<input type="checkbox"/>
22.	Pergola Garage	75c	<input type="checkbox"/>

Name (Please print)

Street

City and State

Mrs. Gowen in Captain's
Cabin of the "Speejacks"
after
returning from voyage



The motor "Speejacks,"
which was purchased by
Mrs. Gowen after
returning from voyage

Around the world with the 'Speejacks'

THE 35,000-mile cruise of this little 98-foot motor yacht was a thrilling exploit, replete with courage, daring, hardship and adventure.

Lonely tropical islands of the South Seas, off the routes of trade—the East India, the Red Sea, the Mediterranean—the empty miles of the Atlantic, were covered by Commodore Gowen and his wife in a wonderful voyage of more than a year.

The log of this amazing cruise was written, from start to finish, by Mrs. Gowen, on a

Remington Portable Typewriter

Here is Mrs. Gowen's own story of how this sturdy machine performed:

"One of the most useful necessities of our equipment for the 'Speejacks' was the Remington Portable Typewriter we purchased before leaving America. It stood the inclement weather, the torrid heat of the tropics and the frequent douchings of salt water without loss of efficiency.

"I don't suppose that any typewriter in existence ever had harder wear or went through a more stormy period than did this typewriter.

"It is in as good condition today as the day we bought it. I am still using my Remington with a great appreciation of its endurance and efficiency."

The Remington Portable has the Standard four-row Keyboard. Fits in a case only four inches high. For sale by over 2500 dealers and Remington Branches everywhere. Write to us for "Your Ever Handy Helper." Address Dept. 67.

Easy payment terms if desired

Remington Typewriter Company
374 Broadway, New York

A good typewriter deserves a good ribbon. Use Paragon Ribbons on Remington Portable Typewriters. Made and sold by us.



THE HOME WORKSHOP

New Motorboats from Old

(Continued from page 99)

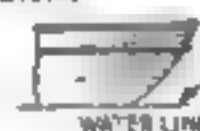
3 ft. or more from the stern. Now that we can get at the inside, we shall carefully loosen up all the planks that run into the stern and lift out the one or two ribs that will be free and also carefully remove the oak timbering under the deck to which the planks were nailed, working back if possible to former joints.

What we want to do now is to shorten the stern a few inches. This will bring the ends of the planks higher, so that when they are sawn off level with the deck, we shall have sound wood for nailing. To do this, we shall have to shave each plank some way back, making long open Vs between each. We shall then get a couple of chain clamps, fasten them well forward as high as possible, with the chains passing round the stern, and screw up until the planks come together again.

Previously to this, however, any planks that are very badly broken, like the one on each quarter, will have to be taken out to the old butt, or to a newly made joint where it is farthest from another. The new planks are cut from the old, which are used as a pattern, not forgetting that the after end will be narrower than before. The planks amidships that contain the rudder trunk and join the sternpost will possibly need renewing; it is worth the trouble to do so if they are at all shaky at the lower end.

Having got the planks in position, so that the bad ends can be cut away, make a shape of oak to fit snugly inside them at the level of the under side of the top strake.

COMPROMISE STERN



TRANSOM STERN (SIDE VIEW)



BANTAIL STERN



TRANSOM (END VIEW)



Three types of motorboat sterns: the transom, the bantail, and the compromise

Join this up firmly to the old clamp, then make another shape to take the place of the ribs removed. Have it solid and arranged to meet the inner side of the planks when upright about 1 ft. from the stern and to screw on to the under side of the horizontal shape. These shapes will be like templates, only very solid, say of 1½-in. oak, or, better, two thicknesses of 1-in. oak screwed together with the grain crossing. To these pieces fasten the planks in their new position, using galvanized nails, brass screws, or, for preference, copper rivets clinched on the inside over burrs.

A new sheer strake will now have to be cut, bent, and fitted. It should be the same thickness as the old. For this, and possibly for any new planks, a steam box will be necessary and will be described later. This being in position, saw the edges of the planks to it; also saw them off vertically in the same line as its outer edge.

Put in a beam or cross piece to hold the deck, nailing it to the shape and the sheer strake. Relay the deck, cutting it to the

(Continued on page 101)

They know why they prefer "B.V.D."

THE cool, keen level-headed men who follow the world of sport and lead the world in comfort—they know the Unvarying Quality, Long Wear and Famous Fit of "B.V.D." Underwear, and make it a part of their formula for getting the most out of life.

From raw material to finished product we practice ceaseless care so that every "B.V.D." garment is of the quality that has brought world-wide preference for our product.

The cool, durable nainsook of "B.V.D." is woven in our own mills from selected cotton and finished in our bleachery.

In our factories vigilant inspection guards every process of skillful cutting, accurate stitching, well sewn buttons and accurate finish.

There is only one "B.V.D." Underwear
It is always identified by this Red Woven Label

Union Suit
(½ L S A)
Men's \$4.50 and upward
the suit
Youths \$3.50 the suit



Underwear and
Socks
\$3.50 and upward
the garment

The B.V.D. COMPANY, Inc., New York
540 Makers of B.V.D. Underwear

© 1911
THE B.V.D. CO., INC.

NEXT TO MYSELF I LIKE "B.V.D." BEST

W. L. DOUGLAS

NAME AND PORTRAIT is the best known shoe Trade Mark in the world. It stands for the highest standard of quality, style and workmanship at the lowest possible cost.

W. L. DOUGLAS shoes are actually demanded year after year by more people than any other shoe in the world.

BECAUSE W. L. Douglas for forty-six years has been making surpassingly good shoes. The smart styles are the leaders everywhere. When you need shoes and are looking for the best shoes for your money examine W. L. Douglas \$7.00 and \$8.00 shoes. They are exceptionally good value for the price. Wear them and save money.

\$5. \$6. \$7. \$8. & \$9. SHOES FOR MEN & WOMEN

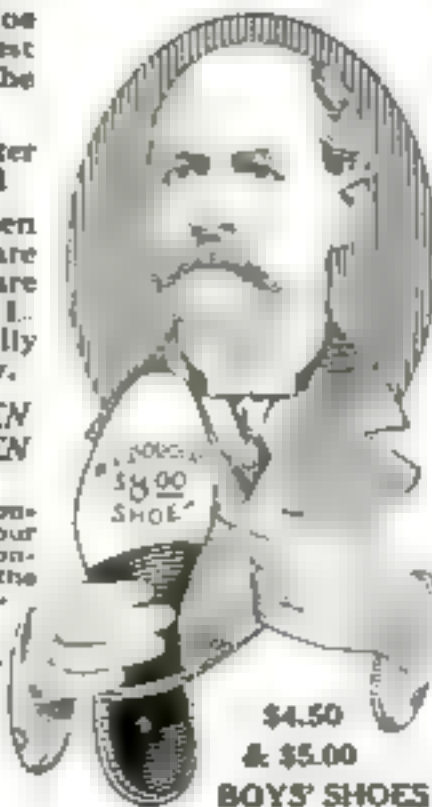
NO MATTER WHERE YOU LIVE

shoe dealers can supply you with W. L. Douglas shoes. If not convenient to call at one of our 114 stores in the large cities, ask your shoe dealer for W. L. Douglas shoes. Protection against unreasonable profits is guaranteed by the name and price stamped on the sole of every pair before the shoes leave the factory. Refuse substitutes. The prices are the same everywhere.

IF NOT FOR SALE IN YOUR VICINITY WRITE FOR CATALOG.

TO MERCHANTS If no dealer in your town handles W. L. Douglas shoes, write today for exclusive rights to handle this quick-selling, quick turn-over line.

W. L. Douglas
President
W. L. Douglas Shoe Co.
126 Spring Street, Boston, Mass.



\$4.50 & \$5.00 BOYS' SHOES

THE HOME WORKSHOP

New Motorboats from Old

(Continued from page 100)

same level as the side planks; remove the clamps, put on new moldings, and you should have a nice, new, strong stern.

Next month we shall examine the bow and sides and, following that, the deck, cabin, and fittings.

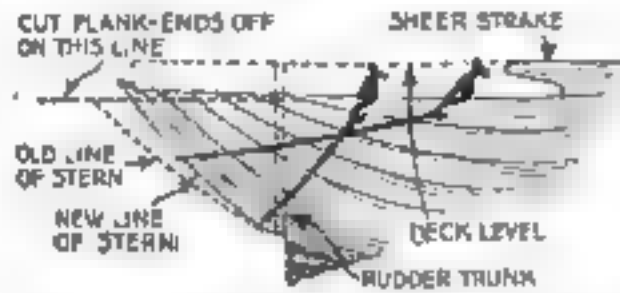


Diagram showing how an old stern may be pulled together, trimmed, and patched up

Cheap Garage Made of Porch Screens and Cement Mortar

WHAT is possible in the construction of a cheap garage is shown by the accompanying illustration. Although this garage is 10 by 18 ft., the walls are merely porch screens that had gone into disuse.



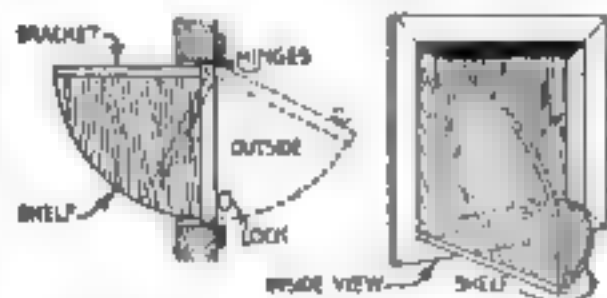
Screens covered with cement mortar

Between the brace pieces of the screens, other pieces are fastened to keep the frames solid, and the frames are nailed to posts. The whole is then plastered over with a rich cement mortar so as to make a perfectly hard and unyielding wall. The result is a garage that, in spite of its lightness and cheapness, will last for years.—ROBERT PAGE LINCOLN.

Answering the Telephone from Outside the House

ANY one whose work is largely outside the house can save many steps by installing this simple panel telephone shelf.

Cut an 18-in. square opening in the outside wall of the building and frame it to receive a hinged door, opening outward. Make the door of heavy stock and provide a key lock or a simple combination lock, then cut out a shelf in the form of a quarter



The telephone shelf swings in and out

circle with a radius just small enough so that it will swing through the opening without touching the sides. Nail this near the inside bottom edge of the door and support it with a vertical wooden bracket of similar pattern and size.

The phone is placed on the shelf and is always accessible to those in the house, but if the owner wishes to answer it from outside, he merely opens the door by the lock and swings the shelf and phone outdoors.—L. B. ROBBINS.

CASH for PRACTICAL IDEAS

together with wide-open Opportunity to alert minds in one of America's Largest and Most Substantial Industries

Pressed Metal is one of the greatest blessings that American mechanical genius has given the world.

Its range of usefulness, economy and convenience to every man, woman and child, is so great that it has hardly begun to blaze the trail of its possibilities.

The Pressed Metal Industry today totals about \$20,000,000.00 a year. If it could realize its full field of utility by a wider public knowledge of its value as a public service, it would crowd ten times that annual output.

Shoe-eyelets are Pressed Metal. Modern railway cars are Pressed Metal. Stew pans, auto-bodies, telephone instruments and door-knobs are mostly Pressed Metal. You begin to get an idea of the range of use. Don't you?

Pressed Metal is *anything* that can be produced by *stamping* from sheets of steel, brass, aluminum, copper or any other useful metal. Take the brakes off your brain and

SELL US AN IDEA

of some new and practical way to utilize Pressed Metal. The Pressed Metal Trade Extension Council will promptly pay for every acceptable suggestion approved by our Engineering Advisory Board.

Please do not trifle with this, as our purpose is serious and constructive and in the public interest. The membership of the undersigned Council includes many of the largest manufacturing corporations in the United States and their purpose and plans are broad and businesslike.

The Plan briefly outlined above should, at an early date, and continuously thereafter, release the *hidden genius* and *practical intelligence* now bottled up in thousands of ambitious workers. After you receive the Pressed Metal booklet, which, of course, you will write for immediately, you will follow this schedule:

1st: Get your inspiration, either by a flash or by deliberate study. 2nd: Formulate it so that it is perfectly plain. Sketch it if it will help any. 3rd: Send it with no money and no references, to the Pressed Metal Trade Extension Council, as undersigned, and await the decision of the Pressed Metal Engineering Advisory Board. If you—but our space is used up—so you will have to get the rest of it out of the Pressed Metal Booklet.

Write Right Away for the Free



It contains full explanation of what we want from you and how you can get it to us in the way most profitable to you. It tells you

HOW TO CAPITALIZE YOUR MECHANICAL TALENT

or inventive genius—or maybe just your "good old common-sense." It tells all the conditions and the amounts to be paid for the successful ideas, and also how to protect yourself against misappropriation of your creative thoughts by others. WRITE TODAY (A post card will do, but, please, make it easily legible so it can be properly filed and acknowledged.) Address

DEPT. PRESSED METAL TRADE EXTENSION COUNCIL
27 QUINCY STREET, CHICAGO

\$25.00 in Prizes

See page 6 in front of book for full details

COMBINATION MACHINE \$11.75

Complete machine with hand crank and built-in motor. It is a combination of a safe, a cash register, and a time clock. It is a perfect combination of all three. It is a perfect combination of all three. It is a perfect combination of all three.

THE HANDIEST TOOL in the WORLD

OLSON MFG. CO.
32 Commercial St., Worcester, Mass.

BOYS!!

LEARN HOW TO PLAY ANY TUNE IN ONE AFTERNOON

FREE

Learn how to play any tune in one afternoon. This is a new and exciting way to learn. It is a new and exciting way to learn. It is a new and exciting way to learn.

Getting Manpower to Jibe with Horsepower

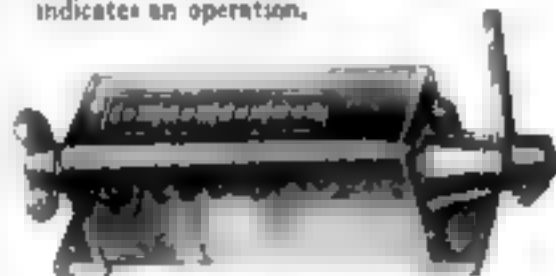
On the *mechanical* end of your machine, a certain amount of horsepower will make things move to your satisfaction.

In the case of the machine *OPERATOR*, it's the power of *Interest* and *concentration* that moves to action and gets output.

When the eye of the operator is on his production-record, his *mind* is on running up that record!—with a result that registers most gratifyingly on your

Veeder COUNTER

The Set-Back Rotary Ratchet Counter below is for machines such as presses and metal-stamping machines, where a reciprocating movement indicates an operation.



Registers one for each throw of the lever, and sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figures, as illustrated, \$11.50—subject to discount. (Cut less than 1/4 size.) Set-Back Revolution Counter of similar model, \$10.00 (list).

This small Rotary Ratchet Counter (No. 6) counts reciprocating movements of the lever, as required for recording

the output of innumerable small machines. When the lever is moved through an angle of 40 to 60 degrees, the counter registers one. The further the lever is moved, the

higher the number registered. A complete revolution of the lever registers ten. This counter can be adapted to no end of counting purposes, by regulating the throw of the lever. Price, \$2.00. (Cut nearly full size.) Small Revolution Counter, also \$2.00.

Everything you could ask in a counting device is shown in the new 32-page Veeder booklet. Ask for this wonderfully complete counter booklet.

The Veeder Mfg. Co.,
44 Sargeant St., Hartford, Conn.

THE HOME WORKSHOP

Attractive Pergola Garage

(Continued from page 79)

himself; and if he is going to choose between making the sash and frames or the doors, it is better to make the doors. The doors, if homemade, should be well braced either with strap irons or sheathing nailed diagonally on the back.

The modern method of providing a foundation for a small garage, such as this, is to lay a substantial concrete floor as large as the outside dimensions of the garage and place heavy anchor bolts near the corners and the doorposts. The sills are then bored to suit the bolts, put in place, and bolted fast.

Before starting the floor, provision should be made for draining it. The best method is to have a plumber run a drainpipe to the house drain, but if it is desired to avoid this expense, a deep hole can be dug in the rear of the garage or at one side, filled with stones, and connected by means of a round tile pipe drain to the garage. The downspout from the roof also may be drained into this hole. Usually this is sufficient provision, as a relatively small quantity of water is used in the garage, and the roof area is trifling.

Water should be piped to the garage, if possible, in the usual way, by digging a trench from the house. This work should be done before laying the floor.

How to lay the floor is described in detail in an article on cement construction on another page. It should pitch from the sides toward the center, where a common iron drain and strainer are placed. The entire floor can slant, but it is often best to have the floor level around the sides and ends and pitched only in the center, where the car stands. The floor should be a little higher than the grade level and the earth banked up on three sides.

Other methods of providing a foundation may be used. One is to build a concrete foundation wall 8 or 10 in. thick and 3 ft. deep; another is to provide concrete piers. Creosoted wooden posts will serve and on good hard ground the garage can be supported on heavy sleepers. The latter methods are frequently used in connection with a wooden or dirt floor.

How the Frame Is Built

The sills are either 4 by 4s or 2 by 4s doubled. The latter are easiest to handle since they are naturally adapted to the half lapped joints at the corners. The corner posts are 2 by 4s doubled and the studs are 2 by 4s placed either 16 or 24 in. from center to center. The studs are cut so as to provide for a fall of 4 or 5 in. from front to back. A single or double 2 by 4 is spiked to the top of the studs to form a plate. The rafters, which are 2 by 6, are covered with the 1/4 by 6 in. tongue-and-grooved ceiling. The 2 by 4s will cut with the least waste if they are obtained in 18-ft. lengths.

The standard construction, it should be noted, is to place the 2 by 4s on 16-in. centers and that is frequently required by building codes. If it is not required, the construction with 24-in. centers will be strong enough. However, if beveled siding is used 16-in. studs are preferable, because the siding needs support at fairly close intervals.

It is really easier for the amateur to use a novelty siding, as it is stiffer and more

(Continued on page 103)

ATKINS METAL CUTTING SAWS



Use
Atkins
"Non-Breakable"
Hack Saw
Blades

End Hack Saw Blade Breakage

WITH Atkins "Non-Breakable" Hack Saw Blades you can not only eliminate practically all losses due to blade breakage, but also do metal cutting faster and easier.

These blades give remarkable cutting results. Made of selected steel, they are hardened and tempered by an exclusive gas and oil process which makes the cutting edge extremely hard and the body of the blade unusually tough and flexible. That's why they out-cut and out-last other blades. Prove it for yourself. Send us ten cents and tell us what metal you cut and we'll send a sample blade. You'll say it's the best you ever used.

No matter what wood or metal-cutting you do, there are Atkins' Saws to save you time, labor and money. Ask for our free booklets on the saws you're interested in.

Get "Saws in the Shop." It's FREE



A 32 page book that's full of practical suggestions on metal-cutting, and general shop information. Every man who buys or uses saws will find it helpful. Send for it NOW! Just write your name and address on the margin of this page and mail it to us.

Do It Now

E. C. ATKINS & CO., Inc.,
Dept. D-20, INDIANAPOLIS, IND.,
Makers of Silver Steel Saws and Tools

THE HOME WORKSHOP

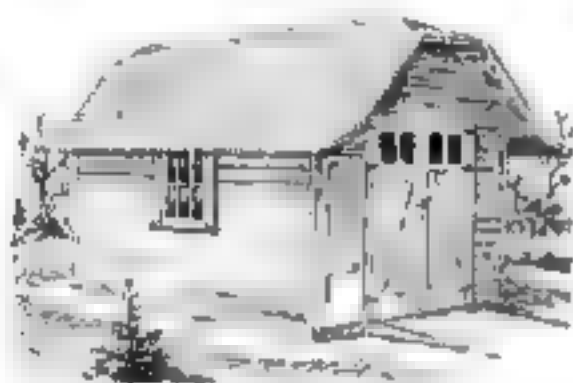
Attractive Pergola Garage

(Continued from page 102)

easily handled. Another advantage is that it permits a considerably simplified corner construction to be used. Instead of butting the siding carefully and accurately against corner strips, the siding is carried to the corners and the strips are placed on top, as illustrated on page 79. Beveled siding should lap about $\frac{1}{4}$ in.; in other words, siding that is $6\frac{1}{2}$ in. wide shows $4\frac{1}{2}$ or $4\frac{1}{4}$ in. to the weather.

A sheathing of rough 1 by 8 or 10 in. boards laid under the siding will make the garage warmer and more durable, or rosin sized building paper or building felt can be tacked to the studs under the siding.

Although double windows are shown on three sides of the garage, one or more pairs



Where a pitched roof is preferred or required by the building code, this style is neat and simple to build.

can be omitted, in fact, the rear windows will be sufficient. It is desirable, however, to have plenty of light, and a good size double-hung window over the bench is an improvement. The addition of a 2 ft. 8 in. by 5 ft. 8 in. door is also often desirable, especially if the garage is used much as a workshop.

The principal objection to this type of garage is that it is not fireproof. The danger of fire is somewhat minimized, however, if only the owner himself uses the garage. He is apt to take all reasonable precautions against fire, especially when he has built the garage himself. In spite of the fire hazard connected with a frame garage, it is undoubtedly the easiest and cheapest for the average home worker to construct.

An improvement possible for any one who has had experience in plastering is to cover the building with stucco. This simply involves nailing metal lath to the studs and covering them with stucco. If the inside also is covered with metal lath and Portland cement or gypsum plaster, the garage will be fire resistant to a considerable degree.

If plans must be filed with the Building Department, the home worker can draw them up very simply by copying the plan, front and side elevations on page 77. This drawing should either be drawn or traced on tracing paper or tracing cloth, so that several blueprint copies can be made.

Or, if preferred, you can obtain as many copies as are necessary of POPULAR SCIENCE MONTHLY's Home Workshop Blueprint No. 23, and fill in your name and address in the space especially provided for it. This blueprint gives fully dimensioned constructional details of the garage, a complete bill of materials, showing exactly what sizes and quantities of lumber to buy, and additional details of

(Continued on page 104)

Be A Transportation Expert—The New Calling

A call to Men who look Ahead



Motor Truck Transportation—already a big and profitable business—is getting better every day. Modern business demands a speed of delivery that only motor trucks can furnish.

Every community requires a Ruggles transportation expert—a trained man who can advise businessmen on their haulage problems.

Men in hundreds of cities who have joined the Ruggles organization are making large incomes. Many of them started in a very small way. There is opportunity for you in your home town or wherever you wish to locate.

This is an opportunity for the man who wants to get into business for himself—who is honest and ambitious—who has the sand to stick to a proposition.

Such a man is offered the franchise for the World's Greatest Truck Value, a line of quality trucks selling as low as \$795, trucks with a record of success and a lineage of experienced men behind them.

Another Opportunity—If the Ruggles franchise is closed in your town you can make big money by operating an express or bus line with one or more Ruggles Trucks. We'll gladly send you full instructions for starting a successful bus or express business on small capital.

Write us in strictest confidence, stating which proposition interests you

RUGGLES MOTOR TRUCK COMPANY, Saginaw, Michigan
Canadian Factory: Ruggles Motor Truck Co., Ltd., London, Ont.

RUGGLES

The World's Greatest Truck Value

SEND FOR THE INTERNATIONAL CATALOG



Full line of auto bodies and accessories in Ford, White, and other makes. See big money-making business.

FOR FORD Prices from \$27.35 up. Factory to consumer direct. Pay only One Part. INTERNATIONAL BODY WORK, 114 W. Ohio St., Dept. 1, Chicago, Ill.

CLASS PINS

FREE CATALOG. This pin illustrated made with any 8 letter and 3 figure code as two colors enamel silver plate, 20¢ ea., \$2.00 doz. Sterling silver, 10¢ ea., \$1.00 doz. Write for catalog of sterling and solid gold pins and rings.

Indiana Pins Co. 634 Madison Bldg., Indianapolis, Ind.

"I have averaged \$7000

Per Year for Three Years—Have Made Over \$90 PROFIT in One Day"

That is the statement of Frank DeFries, one of our live-wire representatives. Frank of Mississippi made \$242 on his first sale. Vickers of Arizona made \$118 in one week. Cannot quit a \$6,000 job to come with us.



DeFRIES

Ford Auto FREE!

We have a plan whereby our active workers can get a Ford without cost, by addition to their big cash earnings. Get the plan—quick!

AGENTS WANTED

We need more men like these, because the demand for our Super Fyr-Fyter is growing by leaps and bounds. Sell to garages, clubs, bar-rooms, schools, homes, hotels, auto parts. Approved by the Postmaster. If you are willing to work and ambitious to make money and money gets out fast. You need no experience as we train you without cost for the work. No gross capital required. Good territory ending fast. Better write us at once.

THE FYR-FYTER COMPANY

1714 Fyr-Fyter Bldg.,

Dayton, Ohio

THE HOME WORKSHOP

Attractive Pergola Garage

(Continued from page 103)

a simple construction for the doors, in case you wish to make them yourself.

The finished garage should be primed, after the knots are shedacked, with a priming coat of paint of the desired color or colors. The nail holes and any cracks should then be well puttied and one or two finishing coats of paint put on.

Be particularly careful to brush the paint on well so as to insure both a good looking and a permanent job. Painting is hard work and the amateur has a constant tendency to smear the paint on quickly and thickly without working it well into the wood. The inside should be given several coats of fire-resisting paint, if possible.

One ingenious home worker painted his garage and all the wicker porch furniture, with a comparatively inexpensive paint sprayer operated by air from the air com-



Two other inexpensive garages with slanting roofs. That at the right is shingled throughout.

pressor on his car. Incidentally, he re-finished his car in the same way and renovated all the screens for the house with a screen paint. In connection with a foot pump, he used the same sprayer for re-finish the radiators through the house, making a much quicker and better job than could be done by a brush, because there were no runs or laps.

A paint sprayer, even if it is of the simple foot-pump type that can be purchased for about \$5, is a valuable addition to the staining, painting, and finishing equipment of any home workshop.

Returning to the garage, if you happen to be in a locality where the building restrictions forbid flat roofs, you cannot use a pergola design and a hip or gable roof should be substituted. Several of the accompanying sketches offer suggestions for this modification.

Various refinements can be incorporated at the time of building or added later, such as an outside storage tank underground with a pipe line to the garage, or a rear addition for a heating plant, and a concrete and drained repair pit with a sliding seat.

Suggestions for doing the necessary concrete work, including making the foundation, laying the floor, and building the roadway, are contained in an article on cement construction on page 112.

Phonograph Needle Scriber

AS A scriber for use in the home workshop, a steel phonograph needle held in a small pin vise or other holder, will give excellent service. It is better than an ordinary pocket scriber because after use the scriber has to be ground, whereas phonograph needles are cheap and can be thrown away when dull. A few kept in the toolbox will insure having a sharp point always on hand.—C. J. WATERS.



\$1000 REWARD For the Capture of This Man

CONVICT 6138, escaped from the State Penitentiary: Name, Charles Condray, Age 37, Height, 5 ft 8 in., Weight 141 pounds, Hair, light brown, Eyes, gray.

Easy enough to identify him from his photograph and this description, you may say—but, Condray took the name of "Brown", dyed his hair, darkened his skin, grew a mustache, put on weight and walked with a stoop.

Yet he was captured and identified so positively that he knew the game was up and returned to the penitentiary without extra trial. How was it accomplished? Easy enough for the Finger Print Expert. They are the specialists, the leaders, the cream of detectives. Every day a paper tells their wonderful exploits in solving mysterious crimes and convicting dangerous criminals.

More Trained Men Needed

The demand for trained men by governments, states, cities, detective agencies, corporations, and private business is becoming greater every day. There is a real opportunity for YOU. Can you imagine a more fascinating line of work than this? Often life and death depend on finger print evidence—and big rewards go to the expert. Many experts earn regularly from \$3,000 to \$10,000 per year.

Learn at Home in Spare Time

And now you can learn the secrets of this science at home in your spare time. Any man with common school education and average ability can become a Finger Print Detective in surprisingly short time.

Free Course in Secret Service

For a limited time we are making a special offer of a *Professional Finger Print Guide*, absolutely free, and *Free Course in Secret Service Intelligence*. Mastery of these two kindred professions will open a brilliant career for you.

Send for Free Booklet



Write quickly for fully illustrated free booklet *Finger Prints* which explains this wonderful training in detail. Don't wait until this offer has expired—mail the coupon now. You may never see this announcement again! You assume no obligation—you have everything to gain and nothing to lose. Write at once—address

University of Applied Science
Dept. 13-65 1520 Sunnyside Ave., Chicago, Ill.

UNIVERSITY OF APPLIED SCIENCE
Dept. 13-65 1520 Sunnyside Ave., Chicago, Ill.
Gentlemen: Without any obligation whatever, send me your new fully illustrated, FREE booklet on Finger Prints and your offer of a FREE course in Secret Service Intelligence and the Free Professional Finger Print Guide.

Name _____

Address _____

Town _____

State _____



The extra H.P. safe, fast motor

Safe rudder steering—no dangerous pivot turning—the safe family motor. Big, hot spark independent of cranking speed means instant start on first quarter turn. Full 3 H. P.—an extra H. P. over all other light motors, by piston displacement. That's the extra H. P. needed to give speed to seaworthy boats—to buck wind, waves and currents. The most powerful light weight motor—lightest motor per H. P.

Big Bearings—more than double the crankshaft, and connecting rod bearing surfaces of light weight outboards. That means reliability and trouble-free service life. Vibrationless, safety-tilting, weedless, beautiful in design and finish.

Trust Ole Evinrude, the pioneer designer and manufacturer of outboard motors, to build his perfected twin "as light as right" at no sacrifice of power or bearings. Sold only under name Elto.

Elto Outboard and Inboard

HP Fast Light Twin
"As light as right"

Write for catalog that shows you how to judge motor values.

Dealers and Demonstrating Agents. No middlemen. Fine opportunity if your territory is still open. Write.

ELTO OUTBOARD MOTOR CO.

Dept. W Manufacturer's Home Bldg.
Milwaukee, Wis.



Man—An Animal Invention

(Continued from page 34)

invention the great controlling telephone exchange of the human brain would never have been possible at all.

All these inventions—muscles, bones, a body lifted off the ground, warm blood, and the forced circulation of it—were made by animal ancestors that could not in any sense be called human. The dog, the tiger, even the very primitive kangaroo, possess these inventions as perfectly as we.

We come now to two inventions that are peculiarly human, which have determined more than anything else the preeminence of man in Nature. These are the invention of the erect posture and the modification of the two front feet into hands.

How Hands Were Developed

Both of these inventions were made long ago, when the creatures that were to be men were still living in the trees. It was tree living, the clinging to branches and sitting upright on them, that turned the backbone up on end. It was tree living, also, that developed the front foot into a grasping organ that at first learned to hold onto branches and presently to take hold of food and finally of tools.

Every stage in these two important developments can be traced in man's nearest animal ancestors, the group called primates, from the four-footed, handless lemur, up to the manlike apes such as the gorilla, whose hands are almost human in form and use.

Active life in the trees was a great incentive to agility. It made necessary many bodily improvements, a sureness of grasp, the art of balancing the body, the accurate coordination of eye and muscle in leaping from branch to branch; all of which were prerequisite to upright walking on the ground. The human hand and the human foot are extremely ingenious organs, but both contain, as do scores of other parts of the body, unmistakable evidences that they were invented originally for a life of skipping about among the branches high above the ground.

Use of Brain Prolonged Life

And this tree life required, also, the development of corresponding improvements in the great central station of the nervous system—the brain. There had to be perfect coordination between every part of the body or else one fell and died. And so there came to be innumerable new connections between the nerve cells in the brain and outside it, new nerve centers for the relaying of messages, new automatic controls such as that necessary for balancing. There developed, also, great storage chambers where the records that we call memories could be accumulated and automatically thrown in or out of the thought circuit whenever they were needed, thousands of times, perhaps, in a single hour.

Thus our life in the trees forced us to build ourselves a brain. It forced us, also, into another invention that is peculiarly human, being shared only by our nearest relatives, the higher apes. This is the rangefinder eye. The two eyes of man are placed side by side in the front of his head. They can judge the distance from branch to branch or other distances. They give us a conception of solidity exactly as the two lenses of the rangefinder give to the

(Continued on page 106)



One of these panels fits your set

YESTERDAY you would have had to wait while the size was cut from sheet stock.

Today you can get the panel you need immediately. Celoron Radio Panels come in standard sizes, one of which will be right for any set you may build.

Each Celoron Panel is already cut and wrapped ready for you to take home. Full instructions for working and finishing are on the glassine paper around every panel.

The sizes meet the present day needs of set-builders. Your dealer will supply you with any of the following sizes:

- | | |
|-----------------|--------------|
| 1.—6x 7x1/8 | 4.—7x18x3/16 |
| 2.—7x 9x1/8 | 5.—9x14x3/16 |
| 3.—7x12x1/8 | 6.—7x21x3/16 |
| 7.—12x 14x 3/16 | |

Also comes in sheets and can be cut in special sizes when desired.

Condensite Celoron has high insulating qualities, high dielectric strength and low dielectric losses. It is used by many of the leading manufacturers of radio equipment. It is easily machined and can be sawed, drilled, turned, or milled.

Send for free booklet

We have prepared an attractive booklet, "Tuning in on a New World," which tells more about Celoron and gives lists of leading broadcasting stations in the United States and Canada, symbols used in reading radio diagrams, and several highly efficient radio hook-ups. This booklet will be of use to every radio fan and will be sent to you free of charge upon your request. Write today.

Diamond State Fibre Company

BRIDGEPORT

(near Philadelphia)

PENNSYLVANIA

Office in Principal Cities

In Canada: Diamond State Fibre Company of Canada, Limited, 245 Carlaw Avenue, Toronto

To radio dealers:

Celoron Radio Panels cut in standard sizes offer an exceptional opportunity for quick sales and substantial profit. Write for special dealer price list showing standard measurements.

CONDENSITE CELORON STANDARD RADIO PANEL

\$25.00 in Prizes

See page 6 in front of book for full details

Only \$45.00 For This Job Complete

See Page 6 in front of book for full details

HAIR GROWS!



When our Vacuum Cap is used a few minutes daily. Grow on 60 days FREE trial at our expense. Stops falling hair and dandruff. Science combined with common sense. No drugs or electricity. A postal brings illustrated booklet.

Modern Vacuum Cap Co.
408 Barclay Denver, Colo.

PROFITABLE SPARE TIME WORK

AMERICAN CHIME CLOCK CO., 1675 Ruffner St., Philadelphia, Pa.

BUILD YOUR OWN GRANDFATHER'S CLOCK WITH OUR HELP

We furnish the parts, finishing material and instructions. Buy the work of all weights and pendulums from us at surprisingly low prices. You make a fine profit building artistic clocks for your friends. Complete Works \$1.00.

Others with Chinese at all prices.

Ask for our attractive Free Catalogue



The New Tool You Are Looking For

The Simore Lightning Change
Magazine Screw Driver

3 Blades—Change them in 2 seconds

GRAVITY DOES THE TRICK

PRODUCES INSTANTLY THE DESIRED BLADE

Gravity produces the blade you want as you tip the handle as illustrated—a quarter turn of the knurled cap at the base of the blade locks the blade for use. When thru turn the cap again and the blade springs back into the magazine.

A turn of the end cap locks the three blades in the handle—you can't lose them—never in the way—always ready for use.

You need this in your
Radio equipment.

You'll say it's handiest thing you ever saw. For the man or woman around the house it's just right. Mechanics, carpenters and cabinet makers won't be without it. Once they see it, it is a brand new tool the strongest of its size and kind. Send for one today. Each tool guaranteed.

Simon & Skidmore Mfg. Co.

110 E. 6th St., Santa Ana, Calif

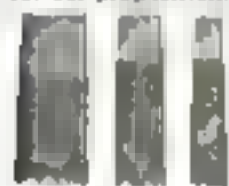
MAKERS OF THE SIMORE AUTOMATIC UNIVERSAL
NUT AND

A turn of the fingers and the
blade disappears instantly!

\$1.80

Prepaid

Dealers and others
are invited to write
for our proposition.



There are three steel
blades, each care-
fully ground to fit
the screw slots.

The Most Wonderful Radio Loud Speaker in the World

\$28.50

The DICTOGRAND With the Adjustable Air Gap



The Adjustable Air Gap

consists of an adjusting dial mounted in front of the cabinet by means of which the distance between the magnetic poles and the diaphragm may be increased or decreased, thus varying the pull of the magnet on the diaphragm and permitting tuning up in complete harmony under all varying conditions of reception.

Overcomes the defects common to all other radio loud speakers—the harsh jarring sounds, the noises and overtones. It creates the illusion that the artists are in the very room with the listeners.

The DICTOGRAND RADIO LOUD SPEAKER is designed to operate on any vacuum tube receiving set, giving maximum results when two stages of amplification or more are used. Requires no extra batteries. You simply plug in—and listen.

The DICTOGRAND RADIO LOUD SPEAKER, like all Dictograph products, is guaranteed for a period of one year against all electrical or mechanical defects.

ASK YOUR DEALER TO DEMONSTRATE IT

The unusual demand upon our facilities has not enabled us to complete our distribution. If your dealer has not yet received his stock of DICTOGRAND Radio Loud Speakers, send to us direct.

THE DICTOGRAPH PRODUCTS CORPORATION

Dept. 1311, 220 West 42nd Street, New York City

Branches in All Principal Cities

Dealers Order through your jobbers or send to us direct for names of authorized distributors.

Man—An Animal Invention

(Continued from page 105)

gunner a measure of how far away he is from an enemy ship.

Consider the eyes of a rabbit. One is on each side. Neither of them can have, except very slightly, the same field of view as the other. The world of the rabbit is a one-eye world. His conception of what we mean by space and by solidity must be a very curious conception.

It is difficult to overestimate how much of our knowledge of the real world around us we owe to this circumstance that we can look at the same object with both of our eyes at once.

Merely an Outline Possible

This gives you the barest outline of the story of the animal inventions; a few of the many great inventions on which the wonderful edifice of the human body is built—muscles, bones, blood, a forced oxygen supply, a massive brain alone packed with active nerve cells, a hand freed from the burden of body support, two eyes that see distance and know the world for three dimensions instead of two.

Many others we have perforce left out of the picture. There is, for instance, the great invention of sex, with its recurrent mixture of two strains in each generation, its unparalleled possibilities of bodily variation, of being able to invent and try out each tiniest modification that might prove to be of value to the race.

We have left out, also, the story of how life spread upward from the land surface into the air; of the successive invention of flight by five different creatures in five different ways; first the insects, which took wing more than three hundred million years ago; next the great flying reptiles or pterodactyls; then, in turn, the birds and the mouse-like bats; and, finally, man himself, who flies because his free hand and his massive brain have permitted him to bend lifeless tools to his uses, to invent machines that do for him what he does not choose to do for himself.

Where Man Has Surpassed Nature

And, finally, a word about one invention in which man has surpassed Nature. This is the wheel. Our two legs may be considered as two spokes of a rimless wheel. They move backward and forward instead of around. Wouldn't a wheel have been better? Could we not move faster and more freely if we rolled along instead of walking?

Mechanically, the answer is yes. Nature has not been able to arrange it because our legs have to be fed. Blood vessels and nerves must run to them from the life centers of the body. Hence there must be a fixed attachment at joint of the hip and rotation through a complete circle is impossible. Our back and forth gait in walking is a price we pay for the advantage that our legs renew themselves and their own energy.

And now may we expect further inventions from Nature? Will she give us bodily wings like the birds, or a few more eyes, or improved gills so that we can live under water if we want to?

Almost certainly not. The path of further evolution seems marked out for us in a quite different direction. It is evolution of our intelligence. Nature's inventions from now on will be, probably, our

inventions; the kind that we record in the Patent Office. When we fly, we shall use airplanes. If we wish to live under water, we shall go there in a submarine.

This has already been true, indeed, for many thousands of years. The bodies of modern men do not differ materially from those of prehistoric men 100,000 years ago. Where man does differ is in his brain, in accumulated knowledge, in greater control of tools and of the non-living forces of nature.

What man is today he has won mentally during his long progress upward from savagery.

Q Next month—one of the most thrilling chapters in this amazing series.

In it—How science traces our monkey ancestry. The wonder story of man's descent from little catlike creatures that skipped about in the treetops many millions of years ago.

If you have wondered how closely related we are to the monkey and the gorilla, you will find the scientific answer in "The Story of Man and His World" in **POPULAR SCIENCE MONTHLY** for June.

The next installment of this most thrilling of all human dramas will be on sale at your newsdealers May 10.

For Further Reading

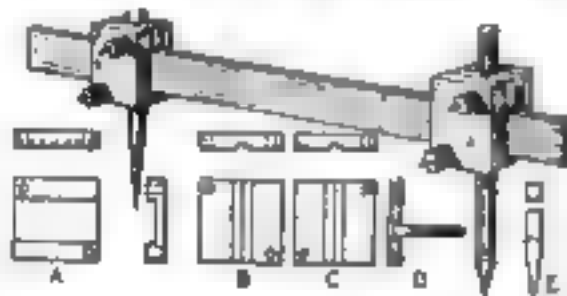
AN EXCELLENT account of the evidence for evolution is "Organic Evolution" by Professor Richard Swann Lill. The Macmillan Company, New York, 1921. "Animals of the Past" by Frederic A. Lucas. American Museum of Natural History, New York, 1912. Is an interesting short account especially well illustrated of some of the ancient animals and of their contributions to the development of life.

A discussion of the human body as a group is "The Essence of the Human Body" by Sir Arthur Keith (Lippincott and Company, Philadelphia, 1920).

How to Make a Beam Compass for Large Circles

ONLY a hacksaw, a small drill, and a fine file are required in making the neat beam compass illustrated. Such a tool is always valuable in the home workshop when large circles are to be drawn, and this one is particularly useful because it will hold a hexagonal or round pencil, a piece of chalk or crayon, a ruling pen with a handle, or a scriber.

A brass strip $\frac{1}{4}$ by $\frac{1}{4}$ by 6 in. and one length of $\frac{1}{16}$ by $\frac{1}{4}$ by 18 in. are necessary. Cut out three $\frac{1}{4}$ -in. squares. Then

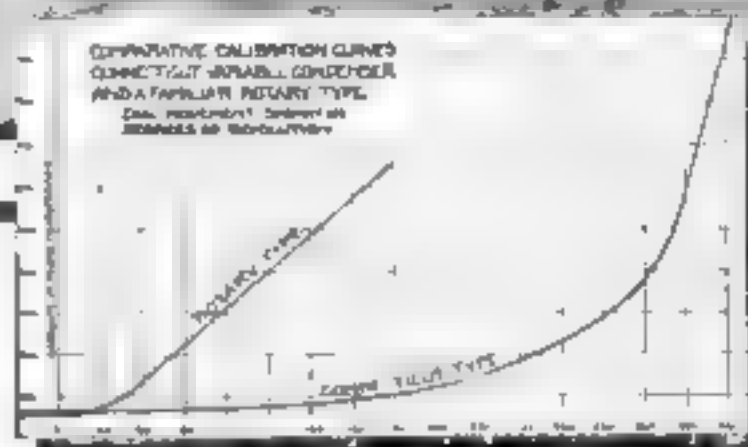


This simple compass can be used with pencil, ruling pen, scriber, or even chalk and crayons.

In one of them, A, cut a recess $\frac{1}{4}$ in wide and $\frac{3}{64}$ in deep in which a $\frac{1}{16}$ by $\frac{5}{8}$ in. bar can slide. In a similar piece, B, cut a V groove and drill two small clearance holes for the screws that are to be used. In piece C cut a V groove and drill and counterbore two small holes so that the screws can be riveted in them. Two sets of these parts are required.

For the screws, D, and the knurled nuts E it is usually possible to find discarded electrical parts that will serve. The compass points, E, can be made of $\frac{1}{4}$ -in. square brass. The parts are then assembled as shown.—P. A. DASCHKE

CONNECTICUT RADIO



This Tells the Tale

Which Variable Condenser is Best for Your Set

Up to 400 micro-microfarads—the extreme capacity ordinarily employed in designing circuits for short wave lengths—the CONNECTICUT Variable Condenser has over 300 degrees of dial movement.

This gives a working range two and one-half times greater than that of the plate type instrument. Dial movement makes such slight capacity change that most accurate settings are possible.

These features to-

gether with the neatness of its design, the compactness of its construction, the length of its scale (350° against 180°), the low waste of signal energy, the impossibility of short circuiting, and the way in which it is shielded from outside fields, all combine to give the CONNECTICUT Variable Condenser an immense advantage over the

ordinary plate type of instrument and make it the most practical improvement you could adopt for your set.



Panel Type, J-108
(illus.) \$5.50

Portable Type,
J-107 \$6.50

Booklet 100-C describing Connecticut Variable Condensers (a trial) will be sent upon request.

RADIO DIVISION



CONNECTICUT
NEWBURY

TELEPHONE
& ELECTRIC

COMPANY

CONNECTICUT

Here's the Lathe for

Inventors Experimenters
Mechanics Auto Repairmen

Here's the lathe that will instantly answer inquiries for a small, compact, accurate and thoroughly modern machine tool for your workshop. The MONARCH Junior 9" Engine Lathe is fully equipped with all the latest and best features. It will do any small work with 10000 ft. of accuracy. Built with tool lengths up to 5 feet. Much to interest you with 1 inch swing and 10 inch bed.



MONARCH
Junior 9" Lathe
\$225

SEND for Free catalog of MONARCH lathes which are built up to 30" swing.

THE MONARCH MACHINE TOOL CO.
481 Oak Street
SIDNEY, Ohio



PREPARE now for the finest vacation you ever had. Make it possible with the WATERFORD, a complete motor boat that you can pull up on the beach, drive in shallow water—over submerged logs or rocks in absolute safety. A regular family boat—moderately priced—that you will want at your cottage this summer.

Write for illustrated booklet "1000 Miles in Canadian Waters" and descriptive folder.
DISAPPEARING PROPELLER BOAT CORPORATION
223 Robinson St., North Yarmouth, N. Y.

WATERFORD
The Disappearing Propeller Boat

THE HOME WORKSHOP

Secrets of "Antique" Furniture

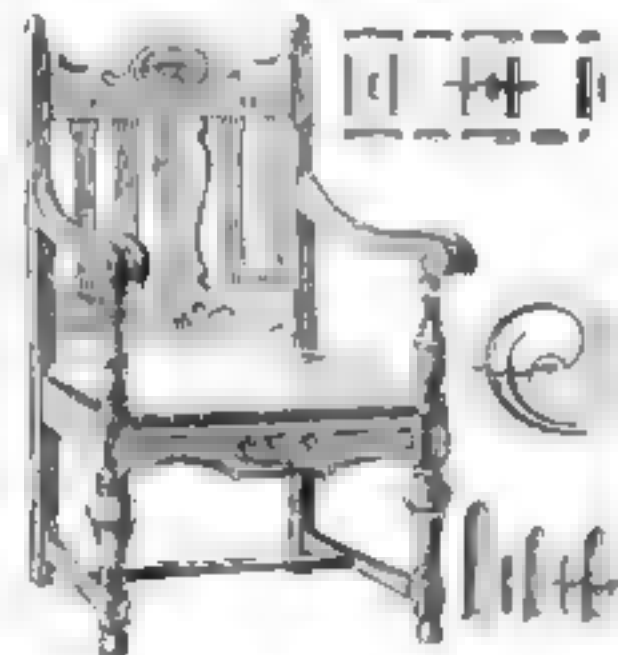
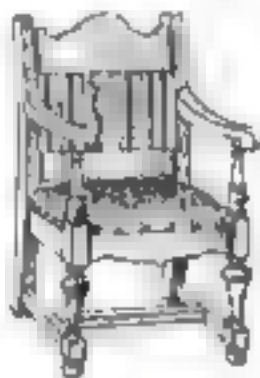
(Continued from page 108)

wear. The process should not be used for surfaces that are to be highly polished.

In Elizabethan and other heavy pieces it adds realism to bore holes through mortise and tenon joints or where mortise and tenon joints would have been used if the piece had been made by an old time cabinetmaker, and plug them with dowels to represent pinned mortise and tenon joints. The pins add points of interest to the surface.

What can be done in the way of giving an antique appearance and a greatly increased value to a commonplace piece of furniture is shown by the accompanying illustration of a so-called William and Mary chair before and after the "antiquing" process. The chair was a cheap example of factory furniture of oak, finished a nut brown, with an imitation Spanish leather upholstered seat. It was bought several years ago for about eight dollars.

The first step in remodeling it was to remove the cheap varnish finish with a commercial varnish remover and by scraping. Since the edges were to be rounded



A cheap "factory" chair before (above) and after (below) "antiquing"

more or less, as if by wear, it was unnecessary to take any particular pains with the scraping. In fact, some parts, particularly the lower rails and stretcher, were shaved off with a spoke shave until they were considerably rounded.

The next step was to improve the appearance of the chair with some very simple carving done with ordinary woodworker's gouges, chisels and penknife. The upper edge of the back was chamfered a trifle at each side. Shallow imitation carving on the back was deepened and extended a little. The work was done in such a way that the marks of the tools remained visible.

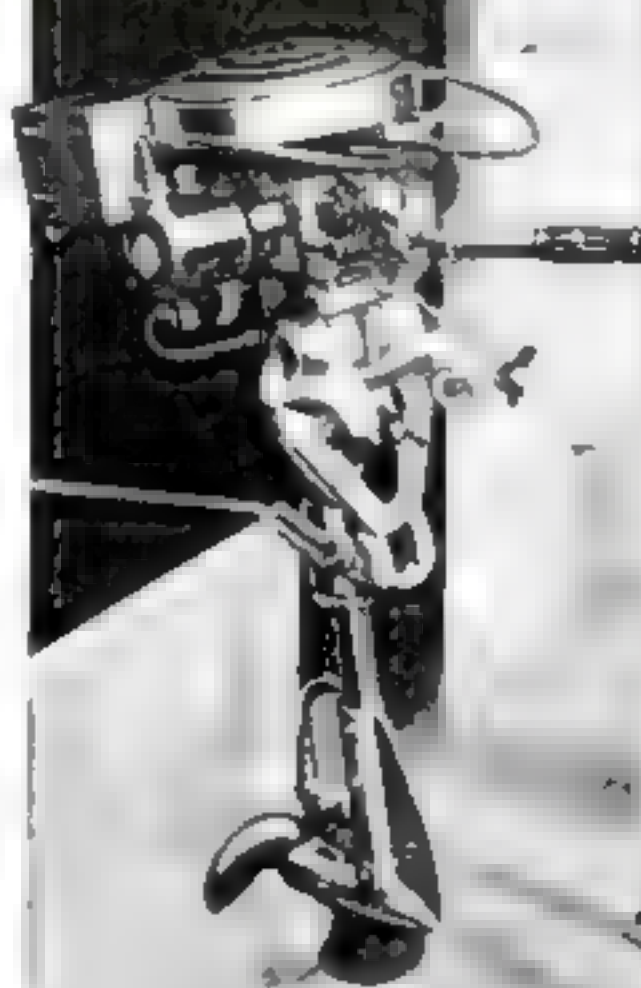
A row of gouge marks were then cut across the upper back piece, as shown. The edges of the center slat were beveled and a line of ribbon carving added. The other slats were cut at the edges and relieved with a few straight gouge marks. Other simple carving was used to ornament the lower rail and the back and the front and side rails of the seat.

The arms were hollowed as shown, and

(Continued on page 110)

EVINRUDE

Announce the SPORT TWIN



Let's look at it

When you see the Sport Twin you will know why it is called the Sport Twin.

It is a twin cylinder motor with a built-in flywheel, a motor with the ruggedness of a motor and the beauty of a motor.

SPORT TWIN FEATURES

Weight 40 pounds complete—no batteries or extra weight. Two cycle vibrationless two 11 P. H. cylinders. Built-in flywheel.

Automatic Reverse and Tilt-Up—perfect control of boat—absolutely safe.

Genuine float feed carburetor—wonderful flexibility of power. Cast in aluminum and nickel plated. It is good as it looks.

See it at your nearest Evinrude dealer. It is the best outboard motor in the world.

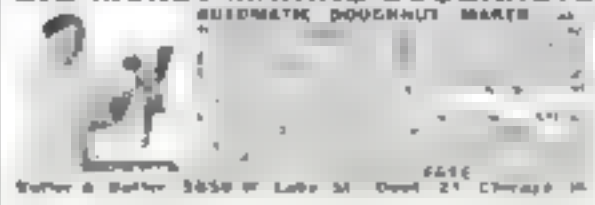
EVINRUDE MOTOR COMPANY
165 Evinrude Bldg. Milwaukee, Wis.

DISTRIBUTORS

See list of distributors in this issue. Write for Catalogue No. 1.

Complete line of detachable and built-in motors 1 and 2 cylinder models

BIG MONEY MAKING DOUGHNUTS



Write for Catalogue No. 1

Airplane Free

Write for Catalogue No. 1
Lincoln Standard Aircraft Corp.
LINCOLN, NEBR.

7 Diamond Solitaire Cluster

\$200

Down

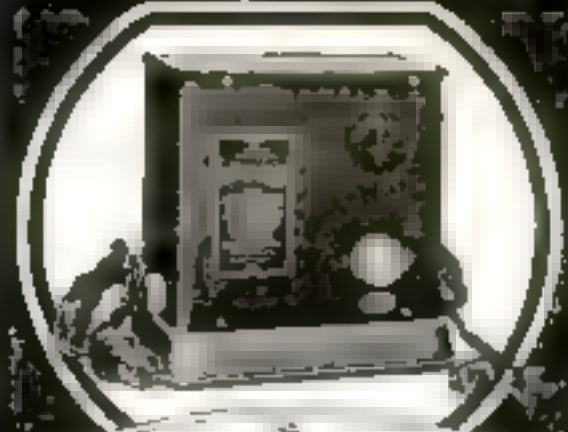
Buy Today
10 Months
to Pay

SPECIAL PRICE \$55.00

FREE

THE HOUSE OF QUALITY
L.W. SWEET INC.
1650-1660 BROADWAY, NEW YORK

CHARGE YOUR RADIO BATTERY at HOME for a NICKEL



PATENTED ARMATURE
Tungsten contacts used
completely no silver or
carbon grids to wear out quickly

Enjoyable and easy and most
important of all, you can
obtain it when your battery
is fully charged.

THE HOMECHARGER

charges your "A" or "B"
battery OVER NIGHT for a
new battery without removing it
from your set. No more
trouble with the old
method. No more
trouble with the old
method. No more
trouble with the old
method.

The HOMECHARGER is the
ONLY battery charger combin-
ing all of these new
features. SEE WHY IT IS
THE ONLY BATTERY
CHARGER THAT IS
RECOMMENDED BY
THE RADIO INDUSTRY.
It is the ONLY BATTERY
CHARGER THAT IS
RECOMMENDED BY
THE RADIO INDUSTRY.

The HOMECHARGER is the
ONLY battery charger combin-
ing all of these new
features. SEE WHY IT IS
THE ONLY BATTERY
CHARGER THAT IS
RECOMMENDED BY
THE RADIO INDUSTRY.

We are FREE to show
you why the HOMECHARGER
is the ONLY BATTERY
CHARGER THAT IS
RECOMMENDED BY
THE RADIO INDUSTRY.

MEET FIRST THE HOME
CHARGER. It is the ONLY
BATTERY CHARGER
THAT IS RECOMMENDED
BY THE RADIO INDUSTRY.

THE AUTOMATIC
ELECTRICAL DEVICES CO.
131 WEST THIRD ST.
CINCINNATI, OHIO

FREE VACUUM TUBE RADIO SET

The set you always wanted FREE
Refrigerator

ABSOLUTELY FREE

HOME SUPPLY CO.
131 Duane St.

GREEN AUTOMATIC MACHINE Add To Your Income



AM SHARPENING MACHINE CO.
Dept. P, 114 W. Washington St., Chicago

THE HOME WORKSHOP

Secrets of "Antique" Furniture

(Continued from page 106)

the corners were cut off the square blocks of the leg turnings. The hard lines of the back legs were varied by a few grooves and chamferings and the corners were rounded a trifle. Turned oak balls were doweled to the top of the back legs. The cheap leather seat was removed and, after finishing, replaced with genuine Spanish leather, and the upholstery nails were set much closer together than before.

The chair was finished by giving it two coats of commercial dark oak stain. Oak paste filler was applied to the parts supposed to appear as if polished by long wear, that is the arms, under rails and the front rail of the seat. When this was dry, red, yellow and blue artist's oil colors were rubbed into the molding and recesses of the turnings and wiped off in such a way as to leave some of the color in the deeper parts. This was followed by a thin white lead brushed over the same parts and wiped off.

On flat surfaces the color was pretty dark and it was lightened in places with diluted nitric acid and a scraper. The chair was next given two thin coats of shellac, each was lightly sandpapered, and then four coats of furniture wax were applied.

Painted Pieces Require Many Coats

For painted work it is merely necessary to apply coat after coat. If one or more of the coats cracks or peels, it will do no harm, simply sandpaper it well and go right on with the finish.

If any of the moldings are gilded, rub the gold hard in places, so that the size is visible. The appearance will be better if the size has previously been colored with Venetian red. It should be borne in mind that the gilded parts of old furniture are often more neglected than the rest.

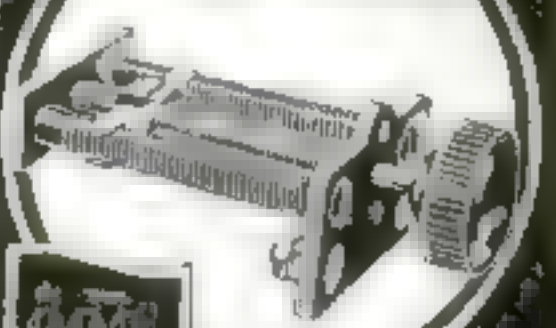
It is always legitimate to use new upholstery, leather, cane and the like for old pieces, because it is conceded that such material will not last indefinitely. It is, however, interesting to know that makers of reproductions can obtain a grade of velvet that is so woven by machine that the nap appears to be realistically worn.

Modern reproductions of antiques, some of which represent the finest cabinet work being done in furniture factories today, at times follow the old fashioned mortise and tenon construction and parallel very closely the methods used in the piece that is being copied, but often the copy is modern in construction. There is a vital reason for this because modern veneered furniture over laminated cores is built in such a way that it will stand the dry, hot air of the American home in winter, and not check and crack under our great changes in temperature, as do practically all genuine antiques.

Well Seasoned Wood Necessary

In setting out to build "antiques" it is important to obtain well seasoned wood. Many English reproductions are made from wood sawed from the oak timbers of old sailing ships. It is a common practice to pickle ordinary stock in a strong brine solution and then dry it in the sun. A coating of quicklime is sometimes used for bleaching the boards. This is allowed to remain on the wood for several months and then is removed with alcohol applied with a stiff brush.

The Autostat A Super Radio Rheostat



Can be used
with any
radio set
to give you
amplifying power of one
to five times

The difference between a
number of cases of volume con-
tingency is that where a
the "Autostat" will give a
powerful and clear sound
to the set and the sound
will be as clear as the
sound of the set and the
sound of the set.

Hereafter, sharp tuning has
of the set, particularly in the
middle of the band, but the
the sound of the set and the
the sound of the set.

The Autostat A Super Radio Rheostat

these much sought-for results
can be obtained by an
Autostat. It is a
small, simple, and
easy to use device
which will give you
the sound of the set
and the sound of the set.

Best is none too good for
the Autostat. It is a
small, simple, and
easy to use device
which will give you
the sound of the set
and the sound of the set.

THE AUTOMATIC
ELECTRICAL DEVICES CO.
131 West Third St.
CINCINNATI, OHIO

Builders of Precision
Rheostats since 1914

SPEEDWAY BODIES

New 1923 Models Write for Catalog!



MORTON & BRET, Indianapolis, Ind.



Save Your Tools
and Save Money!

A place for every tool and
every tool in a GERSTNER
case will last both summer and
winter. A style and price
list will be sent on request.

H. Gerstner & Sons
245 Columbia St., Dayton, Ohio

CLARENCE A. O'BRIEN

PATENT ATTORNEY

REGISTERED IN UNITED STATES PATENT OFFICE

MEMBER OF THE BAR OF

SUPREME COURT OF UNITED STATES COURT OF APPEALS DISTRICT OF COLUMBIA

SUPREME COURT DISTRICT OF COLUMBIA UNITED STATES COURT OF CLAIMS

PRACTICE CONFINED TO PATENTS AND TRADE MARKS

EXPERIENCE

Protect Your Ideas

Any new article, machine, design or improvement thereof, or any new combination of parts or improvements in any known article which increases its efficiency or usefulness, may be patented, if it involves invention.

IF YOU HAVE ANY NEW IDEAS

which you feel are useful, practical and novel, take prompt action toward protecting your rights. If you have invented any new machine, or new combination of parts or improvement, or new process or design,

Send Drawing, Model or Description

of it for information as to procedure to secure protection.

WRITE TODAY FOR BLANK FORM

"Evidence of Conception"

to be returned to me with drawing, description or model of your idea. Promptly upon receipt by me of your idea I will write you fully as to procedure and costs.

NO CHARGE FOR THE ABOVE INFORMATION

All communications are held in strict confidence. My personal, careful and thorough attention is given to each case. I offer you efficient, reliable and prompt service—based upon practical experience. *Highest references.*

Write to-day for free book "How to Obtain a Patent." This book will give you valuable information, and it may save you much time and effort. *Send for it NOW.*

My practice is devoted exclusively to United States and foreign patents and trade marks. Very probably I can help you. Write today.

CLARENCE A. O'BRIEN, Registered Patent Attorney
117 Southern Building - - Washington, D. C.

CLARENCE A. O'BRIEN 117 Southern Bldg.,

Patent Attorney, Washington, D. C.

Please send me your free booklet, "How to Obtain a Patent" and blank form "Evidence of Conception" without any obligation on my part.

Name

Address

(WRITE PLAINLY)

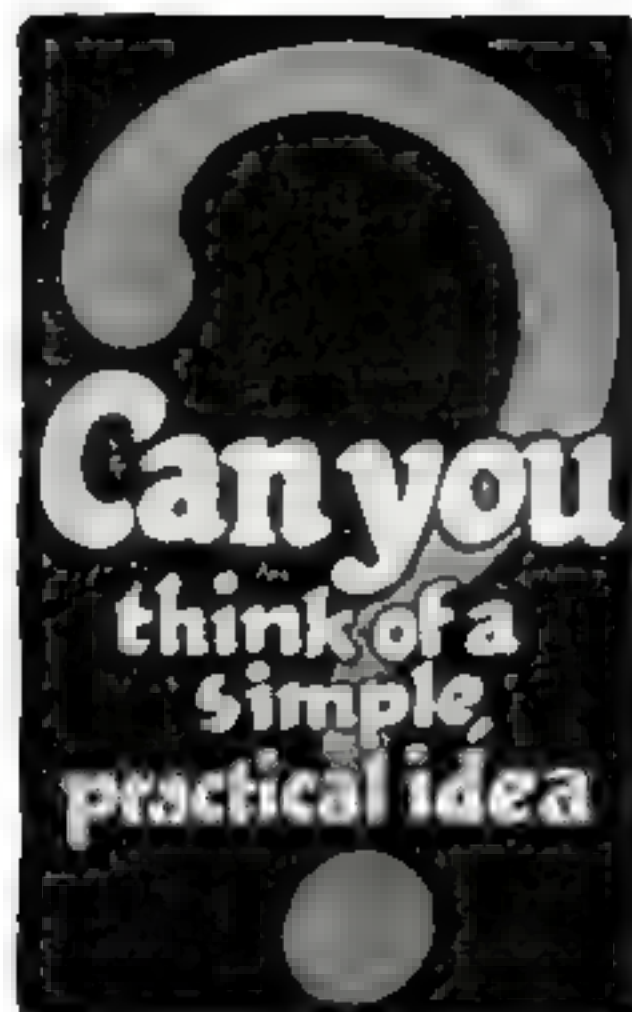


SERVICE

ECONOMY

EFFICIENCY

INITIATIVE



Can you think of a simple, practical idea

A Fortune May be Yours

if you can invent some new, practical thing; or some new and improved method of doing an old thing.

Opportunity Bids You to Reap the Rewards of Original Effort

Protect your ideas; reap the profits from your own genius. Have you a new idea? Can you think of a new and useful invention? We can help you. Write quick for our new free book

"Inventions and Trade Marks, their Protection and Exploitation"

You'll be surprised. This great book tells you many very important and valuable facts on securing Patents and Trade Marks.

It Is Free If You Write Quick

If you have an idea which you think is good, write us for **FREE OPINION**. This may save you considerable money. We help our clients to get the most profits from their ideas; we have facilities not controlled by others, and which are a distinct advantage to YOU.

Patents Advertised Free

In the magazine "Invention and Manufacturing Supplement" published for Inventors. Sample copy free, subscription 30 cents a year.

SEND FOR THIS FREE BOOK

This book will show you how to proceed, what you should do—and why; it tells you many valuable facts about inventions and patents, and about our service. **Don't delay; write today. It may mean a fortune for you. Act Quick.**

American Industries, Inc.
515 Kresge Bldg., Washington, D. C.

Simple Methods for Doing Your Own Cement Work

By Franklin S. Keating

HAVE you a garage drive to build, or a garden walk to lay, or concrete steps to patch up, or any cement work to do around your house, garden, and garage? If so, you can save money by doing the work yourself, or, at least, by supervising it intelligently.

No material can be handled more easily by the home worker and with less equipment than concrete. From patching a curb to casting ornamental garden furniture, there is little limit to the possible uses of cement. And the work is not difficult or expensive. The only drawback is the labor involved in mixing and handling

Laying a cement walk

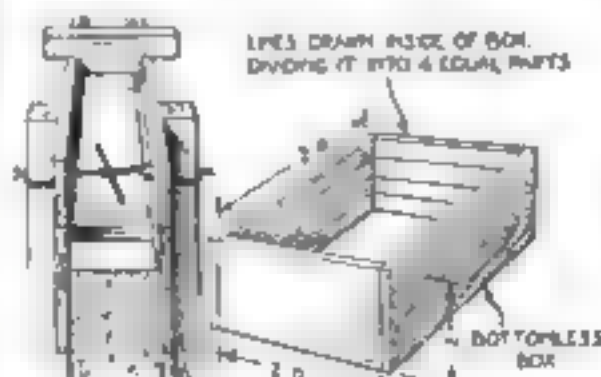


concrete, and that often can be done under your direction by a laborer hired by the day or hour.

The mixing platform should be built of rough green stock. A convenient size is 6 by 14 ft., but a smaller board will serve for most work around the house. A strip nailed to the outer edges on three sides will make it easier to prevent cement being washed over the edges.

A square pointed shovel is best for the mixing. A hose or water apparatus, a sprinkling can, a wheelbarrow, a screen for sifting sand, buckets, a steel trowel and a wooden float are also required. If much sidewalk is to be laid, a groover and edger should be obtained. A tamper can be made if a commercial one is not obtainable.

The best way to measure the correct proportions of sand and aggregate is to make a bottomless box 1 by 2 by 2 ft. (inside and mark it on the inside with lines 3, 6, and 9 inches from the bottom. The frame is placed on the mixing board and filled up



A measuring box and form for foundation wall

to the first level if 1 cu. ft. is desired, to the second level for 2 cu. ft., to the third for 3, and to the top for 4. For small work a mixing frame 6 in. by 1 ft. by 2 ft., containing 1 cu. ft., will be large enough. One bag of cement is considered to be 1 cu. ft., so that the cement does not need to be measured if used in quantities of one bag or more.

(Continued on page 113)

U.S. PATENTS



SEND FOR THIS FORM

DON'T LOSE YOUR RIGHTS TO PATENT PROTECTION

Before disclosing your invention to anyone send for book form "EVIDENCE OF CONCEPTION" to be signed and witnessed. A sample form together with printed instructions show you just how to work up your evidence and establish the same before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the United States and Canada in the advancement of inventions. Our schedule of fees is the lowest reasonable. The form "Evidence of Conception," sample instructions relating to obtaining of patents and schedule of fees sent upon request. Ask for them.—a post card will do.

PATENTS AND TRADE MARKS
LANCASTER & ALLWINE
274 Ouray Bldg.
WASHINGTON, D. C.
Originators of form "Evidence of Conception."

PATENTS

Booklet Free Highest References
Promptness Assured Best Results

Send drawing or model for preliminary examination of Patent Office records and report as to patentability.

All Business Given Prompt and Proper Attention

WATSON E. COLEMAN, Patent Lawyer,
824 F St., Washington, D. C.

PATENTS

PROTECT YOUR INVENTION TODAY

Write for **FREE Illustrated Patent Book** Radio-Electrical, Chemical and Mechanical Experts; Over 25 years' experience. Prompt Efficient Service. Write today

A. M. WILSON, Inc.
222-22 VICTOR BLDG. WASHINGTON, D. C.

PATENTS

As one of the oldest patent firms in America we give inventors at lowest consistent charge, a service noted for results, evidenced by many well known Patents of extraordinary value. Book, Patent Service, Free. Lacey & Lacey, 549 F St., Wash., D. C. Estab. 1896.

PATENTS and TRADEMARKS

We offer a strictly professional service to inventors and manufacturers in the protection of their patents and trademark rights. Valuable and infringement investigations conducted. Correspondence solicited. Moderate fees. Preliminary advice without charge. No obligation.

MILO B. STEVENS & COMPANY
Suite 480 Raritan Bldg., WASHINGTON, D. C.
Suite 237 B Maryland Bldg., CHICAGO
ESTABLISHED 1864

PATENTS

TRADE-MARKS, COPYRIGHTS AND PATENT LITIGATION

Write for advice and assistance. Send drawing or model for preliminary examination of Patent Office records and report as to patentability.

ALBERT E. DIETERICH
Patent Lawyer and Solicitor
Successor to Fred C. Dieterich & Co.
80 Ouray Bldg. WASHINGTON, D. C.

THE HOME WORKSHOP

Simple Methods for Cement Work

(Continued from page 112)

The recommended mixtures for various classes of work are as follows.

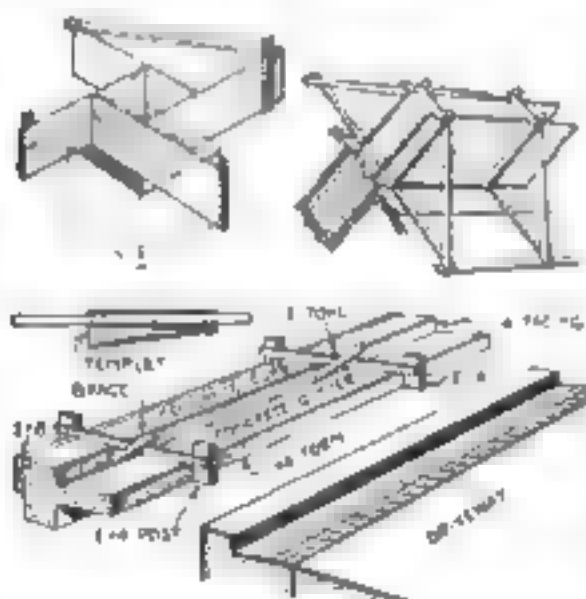
	Cement	Sand	Water
Barren yard stable floor	1	2	3
Drives for trucking	1	2	3
Fence posts	1	2	3
Foundation walls and piers	1	2 1/2	3
Garage drives	1	2	3
Garage floors, one course	1	1	3
Garage floors, base course	1	2 1/2	3
Garage floors, surfacing coat	1	2	3
Garage foundations	1	3	3
Garden walks, flower boxes, ped- estals, etc.	1	2	3
Garage walls, 6 in. thick	1	2	4
General reinforced concrete	1	2	3
Large footings	1	3	4
Machine bases	1	2	3
Roads	1	2 1/2	3
Septic tanks	1	2	3
Steps	1	2	4
Tanks and cisterns	1	2	3
Walks, base course	1	2 1/2	3
Walks and floors, surfacing coat	1	2	3
Walks and floors laid in one coat	1	2	3

Suppose a 1:2:4 batch is needed. First measure 2 cu. ft. of sand and spread 1 bag of cement over it, mixing thoroughly, first dry and then wet; next spread out the mortar and place 4 parts of stone on top and mix thoroughly, adding water as required.

If a lighter aggregate is used, such as fine gravel or ashes, it can be mixed dry with the cement and sand before adding water. The object is to have each grain of sand coated with neat cement, and each particle of aggregate coated with the sand and cement mortar.

For forms, green timber or lumber that is only partly air-dried is actually better than more expensive kiln-dried lumber. The lumber should, however, be of even thickness and preferably planed on one side. The boards should not be wider than 4, 6 or at most 8 in.

Typical methods of constructing forms are illustrated. Care should be taken to



Standard construction for various types of forms

make the forms strong enough, since concrete weighs from 130 to 150 lbs. a cu. ft. When forms are to be used repeatedly, they should be oiled or greased beforehand or brushed with oil and graphite. A good oiling mixture is equal parts of boiled linseed oil and kerosene. Even if not oiled, the forms should be thoroughly wetted before use and cleaned afterward.

For foundation walls and similar work the earth usually will serve as one side of the form up to the ground level. Forms should be left in place until the concrete is thoroughly set. Any heavy work is left from ten days to a month. Rods and bars

(Continued on page 114)

PATENTS TRADE-MARKS AND COPYRIGHTS

SPECIAL OFFER FREE OPINION AS TO PATENTABLE NATURE

Before disclosing an invention, the inventor should write for our blank form "Record of Invention." This should be signed and witnessed and if returned to us together with model or sketch and description of the invention, we will give our opinion as to its patentable nature.



Our Three Books Mailed Free to Inventors

Our Illustrated Guide BOOK

HOW TO OBTAIN A PATENT

Contains full instructions regarding U. S. Patents. Our Methods, Terms, and 100 Mechanical Movements illustrated and described, Articles on Assignment or SALE OF PATENTS, Patent Practice and Procedure, and Law Points for inventors.

OUR TRADE MARK BOOK

Shows the value and necessity of Trade-Mark Protection and gives information regarding Trade-Marks and unfair competition in trade

OUR FOREIGN BOOK

We have Direct Agencies in all Foreign Countries. We secure Foreign Patents in shortest-time and lowest cost.

LIST OF PATENT BUYERS SENT FREE

IDEAS WANTED. Send for LIST OF PATENT BUYERS, containing unsolicited Letters from Manufacturers and others WISHING TO BUY meritorious patents. There is a great demand for NEEDED

INVENTIONS. We endeavor to assist OUR clients in the commercial development of their inventions.

SPECIALIZATION Our Staff

The field of invention is so vast that it is impossible for any one to become an expert in all the different classes of invention. For this reason Victor J. Evans & Co. employ a number of patent lawyers and mechanical experts who have been selected for their special knowledge and ability in certain lines of invention.

THE VALUE OF YOUR PATENT

Will depend much upon the skill and care with which your case is prepared and prosecuted in the United States Patent Office. Every case receives our best efforts, and our work is done consistently skillfully and thoroughly, as is evidenced by the many unsolicited letters of commendation received from our clients. We will furnish lists of clients from any State in the Union for whom we have secured patents.

Our New York, Philadelphia, Pittsburgh, Chicago, and San Francisco Offices

We have established for the benefit of our clients Branch Offices in New York City, Philadelphia, Pa., Pittsburgh, Pa., Chicago, Ill., and San Francisco, Cal. These branch offices located in these large commercial cities, together with our Main Office located near the U. S. Patent Office, in Washington, enable us to more promptly handle the business of our clients, particularly as the branch offices are in constant touch with the Main Office.

Highest References—Prompt Attention—Reasonable Terms

FREE COUPON



VICTOR J. EVANS & CO. Patent Attorneys

New York Office: 1007 West 42nd St. Philadelphia Office: 714-715 Liberty Bldg. Pittsburgh Office: 514 Empire Bldg.
Chicago Office: 1114 Tacoma Bldg. San Francisco Office: Hobart Bldg.
Main Offices: 760 9th Street, Washington, D. C.

Gentlemen: Please send me FREE OF CHARGE your books as described above.

Name..... Address.....

WANTED IDEAS

Inquiries from Manufacturers and Others Who Are Looking for Good Ideas

PROTECTED BY PATENTS

are constantly being received. Manufacturers are always interested in any new device for which there is a market, which fills a long felt need, makes production possible at a lower cost, or which will do the work BETTER. There is undoubtedly a great demand to-day for really worth while inventions.

Your First Step

If you have an idea, send immediately for my blank form "TO RECORD YOUR INVENTION." You should serve your own best interests by filling out and signing this form before you disclose your invention to ANY ONE. This document will help you determine and establish evidence of invention before filing an application in the U. S. Patent office. A copy with full instructions, will be gladly sent free on request.

New Book "Successful Patents" Sent FREE

Every man who has an invention or ever hopes to have one, should send for a copy of my book, "SUCCESSFUL PATENTS." It tells what everyone should know about patents, trade-marks, copyrights, etc. It describes my methods, fees and terms, gives information relative to assignment or sale of rights and instructions in detail. Mail coupon to-day for a free copy of this book—or a postcard request will do.

To the Man with an Idea

I offer a comprehensive, experienced, efficient service for his prompt, legal protection, and will endeavor to aid him in the commercial development of his proposition—my service is distinguished by over 12 years' successful practice, and by thousands of satisfied clients and by reasonable fees.

Send sketch, or model, and description, for advice as to cost, opinion as to its patentable nature, etc. Preliminary advice gladly furnished without charge.

COUPON

RICHARD B. OWEN, Patent Lawyer

Main Office, 4 Owen Bldg., Washington, D. C. Branch Office, 2275-D, Woolworth Bldg., New York City

Please send me, without charge or other obligation, a copy of your book, "TO RECORD YOUR INVENTION" and information regarding patents, etc.

Name _____

Address _____

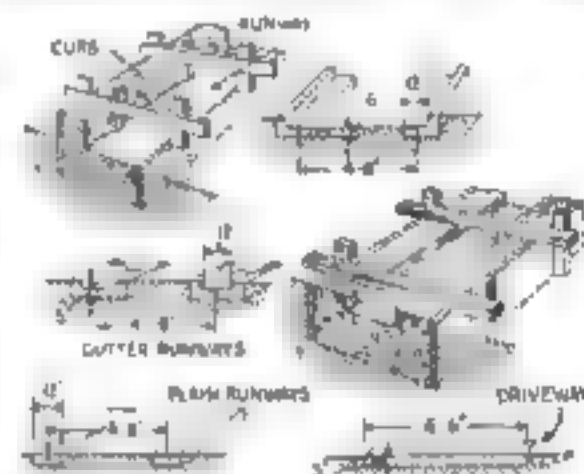
Simple Methods for Cement Work

(Continued from page 113)

usually are used for reinforcing concrete, but for light work poultry netting or wire serves very well and is cheap, and easy to handle.

It is usually better to spade the concrete into place than to tamp it. An old garden spade or a hoe straightened out are good tools to use.

To join new cement to a section laid the day before, wash the surface wet and paint



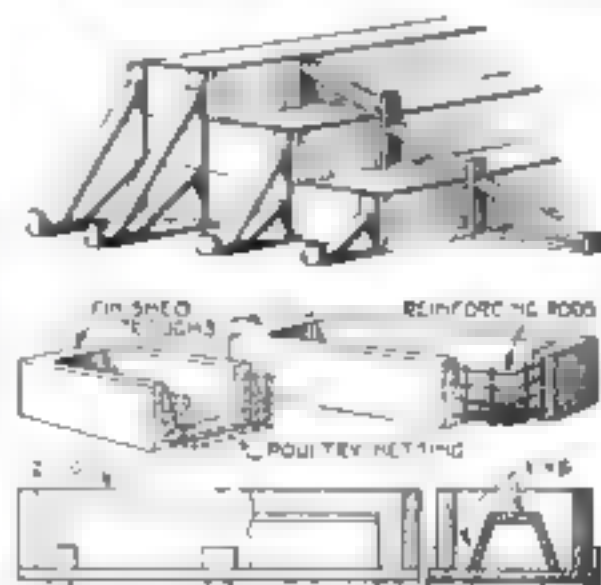
Four different ways for making garage drives or runways

it with cement and water mixed to a creamy consistency.

Concrete for a walk should be laid only on firm, well tamped or trodden ground. Soft places should be dug up and filled with clean gravel or hard cinders. The form should be built of 2-in. lumber as wide as the floor or walk is to be thick, and it usually can be held in position with stakes.

The surface of a finished floor should slope about $\frac{1}{4}$ in. to a foot. A street walk should slope toward the gutter, but garden walks should be crowned about $\frac{1}{4}$ in. to allow the water to run off on both sides.

One or two-course construction may be used. In either case, sidewalks should be 6 in. thick. Masons usually separate a walk into slabs by well-oiled $\frac{1}{4}$ -in. thick



Trough construction and forms for steps

steel plates, which are removed as soon as the concrete is hardened sufficiently. Otherwise care must be taken to cut completely through the concrete when the slab joints are marked out.

A good way for the home worker to lay a walk is first to fill in every other slab and later fill in the intervening places. Care in this detail will prevent the walk's cracking. The edge of each slab should be rounded.

In two-course work the base used may be

Only Safe Blow Torch

The Turner "Master" Burns Kerosene or Gasoline—

Only torch with Safety Valve and Air Release, thus preventing excess or bursting pressure.

Only torch with but one opening in tank—and that far above the fuel.

Only torch with vaporizing baffle—our patented "Hot Spot Hump" that becomes white hot and instantly converts gasoline or kerosene into either fuel into a hot dry gas.

Only torch with adjusting valve fuel control wholly separate from shut off valve. This not only prevents enlarging the orifice but it gives a finer control of the size and intensity of flame.

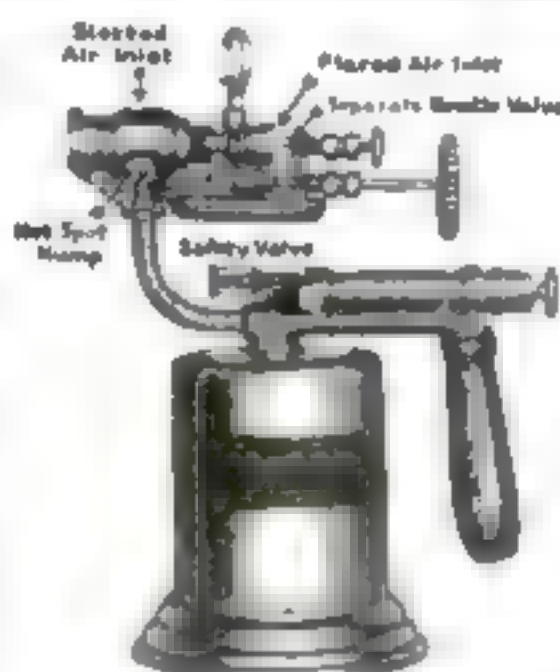
Only torch with automatically-lubricating pump-leather. This means easy pumping and no leakage of air around the valve.

Only torch with pistol grip handle—always comfortable.

All these features are patented. You won't find them in any other torch.

If your dealer has not yet stocked this line of torches, send money order for \$8.25 and his name and address, and No. 45 torch illustrated, capacity 1 qt., weight 4 1/2 lbs., will be sent you prepaid. Ask for our catalog, showing many other sizes and types.

THE TURNER BRASS WORKS
Sycamore, Ill. U.S.A.
Ashland Avenue

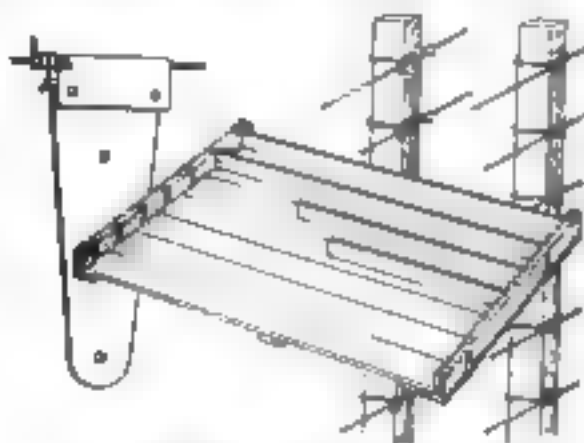


\$8.25

400° MORE HEAT

THE HOME WORKSHOP

4 1/2 in. of 1:3.5 mixture and a 3/4-in. finishing coat of 1:2 cement mortar. A light roller can be used on the concrete as soon as it has been leveled and before the final finish is given with a trowel or float. At-



A mold for bench posts and methods of attaching fence wire to the concrete

though not general practice, walks should be covered and kept moist for several days to prevent too rapid drying.

Concrete drives to the garage should be about 5 in. thick at the side and 6 in. at the center. As in the case of sidewalks, they should be covered with 2 in. of sand or earth or other moisture retaining material for at least ten days, and no traffic should be allowed for at least two weeks. If the road is more than 25 or 30 ft. long, provide at least one expansion joint filled with tar paper or asphaltic felt. Concrete strips or runways will often serve instead of solid road to the private garage. The various types of garage drives are shown in the upper illustration on page 114.

Gang molds for posts may be made as shown above. Four or more reinforcing rods should be placed in each post so as to come about 1 in. inside the corners.

Concrete surfaces may be patched up where necessary and left as they appear when the mold is removed, or they may be painted with one part cement and one part fine sand. They may also be washed so as to remove the surface film of cement, thus revealing the natural color of the aggregate, which is particularly desirable when selected aggregate, such as granite screenings, feldspar or hard black slag, are used. If the forms cannot be removed soon enough for the washing process, the surface may be scrubbed, even if it is quite hard, with 1 part common muriatic acid to 3 or 4 parts of water. Other finishes may be obtained by tooling or bush hammering the surface.

Many interesting color effects can be obtained with colors such as red oxid of iron, mineral Turkey red, metallic brown oxid, yellow ochre, ultramarine blue, chromium oxid, and lamp or carbon black.

Other Uses for Concrete

IF YOUR particular concrete problem is not covered in the accompanying article (pages 112-115), write for further assistance to the Information Department, POPULAR SCIENCE MONTHLY, 225 West 39th Street, New York.

Concrete can be put to such an endless number of useful purposes around the home, farm, and shop, that it is impossible to give more than a general outline of procedure in a magazine article; but detailed information in regard to practically every type of concrete job is on file in the Home Workshop reference library.

PATENTS

Seventy-six Years of Practice

THE firm of Munn & Company filed its first application for a patent in 1846, and for seventy-six years has endeavored to keep pace with the inventive genius of the United States. An experience of many years is at your disposal. If you have an invention which you wish to patent, send your sketches or model together with a description of your device, explaining its operation, and you will receive prompt, courteous attention.

Write for our Handbook on PATENTS

A full and complete booklet on Patents, Designs, Trade-Marks, Foreign Patents, Copyrights, Labels and Patent Office Practice with an explanation about our methods, terms, etc.

All communications strictly confidential

Keep in touch with the inventions of the world by reading
SCIENTIFIC AMERICAN

The MONTHLY MAGAZINE with a special appeal to every man of inventive genius. Recent rulings of the Patent Office, descriptions of the latest patented inventions, legislation and court decisions affecting patents, are noted in this authoritative publication.

MUNN & COMPANY

Patent Attorneys

683 Woolworth Building, New York City

Scientific American Bldg., Room 3, 625 F Street, Washington, D.C.

801-D, Tower Building, Chicago, Ill.

402 Hobart Bldg., San Francisco, Cal.

PATENTS

TRADE-MARKS

COPYRIGHTS

Send for our free book of patent information

Beale & Park

884 F St., Washington, D. C.
14 S. Broad St., Philadelphia, Pa.



PATENTS

Send us sketch or model for patentability opinion and exact cost of patent. Our book "How to Obtain a Patent" sent free on request. It tells how to secure for Patents, Trade Marks, Foreign Patents, Copyrights, etc. gives information on Patent Procedure, tells what every inventor should know. Thousands of inventions, who are not known, are our references.

CHAMBERLAIN & CHAMBERLAIN, 21 West 42nd Street, Washington, D. C.

PATENTS

IF YOU HAVE AN INVENTION and DESIRE TO LEARN HOW TO

SECURE A PATENT, send for Our Guide Book, HOW TO GET A PATENT, sent free on request. Tells our Terms, Methods, etc. Send model or sketch and description of your invention and we

will give our opinion as to its patentable nature.

NAME

STREET

CITY STATE

RANDOLPH & CO.


130 F St., N. W., Washington, D. C.

THE HOME WORKSHOP

Automatic Dibble Saves Time in Transplanting Small Plants

HAVING to transplant many thousands of plants of growing celery for the market, I find that much time can be saved by the use of an automatic dibble.

Each wheel is 2 ft. in diameter and 3 in. wide, with two 1-in.-wide iron tires placed so as to leave a 1-in. space in the center of the wheel face. In this space holes are



WATER
DIPPERS
SPRINKLERS
Spaces holes automatically and sprinkles them with water

bored 8 in. apart and pointed pegs of very hard wood are driven into the holes.

By means of a watertight wooden tank and pipe or hose, a supply of water is carried back of the wheels directly over the dibble holes. The spray of water passes through cups with sieve bottoms so gently that the earth is not disturbed, as it would be by a direct stream. Stopcocks regulate the water discharged through the hose.

The cart itself is drawn by two men. It saves about half the time of my former method.—W. H. J., Sidney Center, N. Y.

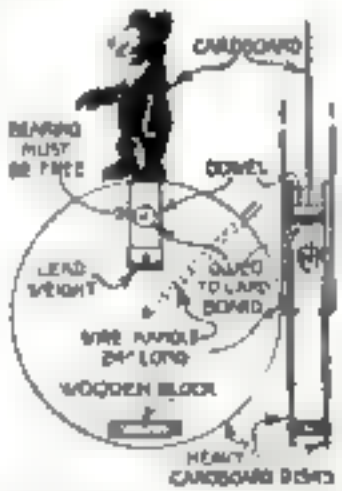
"Teddy-Be-Nimble" Toy

THIS unusually funny toy can easily be made by the man who enjoys constructing playthings for his children. The comical looking bear is mounted between two disks in such a way that when the toy is pushed along, the bear comes popping up above the wheel at intervals and then disappears.

The wheel is made of two disks of heavy cardboard held together by a small block of wood on the bottom and two short lengths of dowel at the top into which run the rails that form a support for the bear.

The bear is drawn on paper and pasted on cardboard long enough to extend down to where the weight is attached. The bear can be duplicated on the reverse side, if desired. The bear is then cut out and a weight attached to the lower end of the cardboard, as shown. The disks are fastened to the block and dowels with flat-headed nails, and a suitable handle is made of wire. The end of the handle is bent so as to slip through holes at the center of the disks. A colorful design can be painted on the disks or they can be left plain.

The bearing for the bear must be free so as to turn easily, and the lead weight must be trimmed until it is just sufficiently heavy to overbalance the bear.—D. W. C.



CARDBOARD
BEAR
LEAD WEIGHT
DOWEL
WIRE HANDLE
WOODEN BLOCK
HEAVY CARDBOARD DISK

Own This

GENUINE

DROP FORGED STEEL

ASTRA AUTOMATIC

Protection!

Buy Direct from Sole U.S. Importers

And Save 1 1/2 2



\$8.95

25 Caliber
7 1/2 in. barrel

With Trade In
Safety
10.95

12 CALIBER
4 1/2 in. barrel

BOTH MODELS SHOOT ANY STANDARD AMMUNITION

The ASTRA is the finest European Pistol and the equal of any similar American weapon retailing at \$25 and \$25 up! It is the standard of the Spanish Army, and after exhaustive tests was adopted by the French Army during the war. The ASTRA has heretofore always been sold through retail stores, but the competition of cheap cast iron pistols has forced us to sell Direct to You, ELIMINATING THREE PROFITS—Jobber, Wholesaler and Retailer!

WARNING! Cast iron guns are very dangerous! We Guarantee the ASTRA is of Drop-Forged Steel throughout! Before buying any weapon, INSIST on this guarantee. We also absolutely guarantee the ASTRA against inferior workmanship! If you are not entirely satisfied, return within 60 days and we will immediately refund your money.

SEND NO MONEY

—unless you wish. Fill out coupon, write name and address plainly, showing gun you wish. We will ship by return mail.

Protect Your Home and Loved Ones. Mail This Coupon Today!

California Trading Company

Dept. 15, Terminal Bldg., Los Angeles, Cal.

In accordance with the terms of your advertisement, send me _____ ASTRA AUTOMATIC _____ I am enclosing money order for _____ Or I will pay purchase on arrival.

Name _____

Address _____

City _____ State _____

5 Master Keys

Work like magic in opening any or every window, door, chest or partition. Are made of steel. Open and lock thousands of different locks. In operation you are in total control. Master windows and only key of the lock. Send \$1 today. Travel key chain FREE with set.

Master Key Co., 4-8 Madison Blvd., Milwaukee, Wis.

DIAMONDS-WATCHES

CASH OR CREDIT

Send for Free Catalog

\$1.00

LIBRARY BONDS ACCEPTED

LOFTIS BROS. & CO.

Dept. 24-271, 500 W. State St., Chicago, Ill.

-that eyes may see better and farther-





An interesting booklet "What Lens Shall I Buy?" describes our complete line of optical goods. Write for a copy and see the Tessor at your dealer's.

BAUSCH & LOMB OPTICAL COMPANY

435 St. Paul St., Rochester, N. Y.

New York Washington Chicago San Francisco London

No Speed Too Fast

A running horse, a rushing car, a speeding boat—the Bausch & Lomb Tessor gets them clearly and sharply. No lens can surpass it for speed work, yet its remarkable definition at full opening makes possible snapshots indoors or on cloudy days when ordinary lenses require time exposures.

The Bausch & Lomb TESSAR LENS

is the anastigmat lens for both amateurs and professional—made by America's leading optical house.

What a clear tone



The announcer's voice is distinct, the music as clear as a bell, because her radio outfit is equipped with the

Stromberg-Carlson Radio Headset

Comfortable, quickly adjustable to any size head—tether cord permits use by two observers.

Backed by 8 years' experience in the manufacture of radio apparatus and 24 years in the manufacture of high grade telephone equipment

Order Stromberg-Carlson apparatus through your electrical dealer or write us for free bulletin No. 1029-PS describing exclusive Stromberg-Carlson features.

**STROMBERG-CARLSON
TELEPHONE MFG., CO.**
Rochester, N. Y.

THE HOME WORKSHOP

Radio Trouble Tips

(Continued from page 114.)

If you are in doubt about this contact, you can either bend the springs of the socket upward, or else touch a little solder to the ends of the tube prongs, being careful not to overheat them while doing it, and also seeing that the solder so applied is not bulky and lumpy.

One of the important things in connection with all double or three circuit tuners is the arrangement of the serial tuning condenser. Many fans ask, "Which is better—to place the condenser on the serial side of the variocoupler primary, or on the ground side?" The same question applies also, of course, to honeycomb sets.

The answer is: "On the ground side." Not only that, but the rotor plate of the condenser should be connected with the ground and the stationary plates with the inductance, be it variocoupler primary or honeycomb coil.

Grounding the Filament Circuit

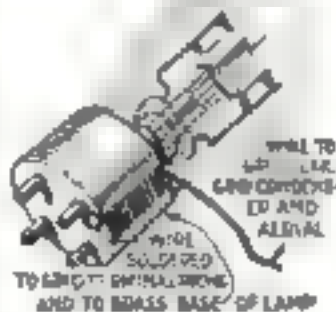
In this connection there is another good tip for users of double circuit sets. When the serial tuning condenser is on the ground side of the primary circuit, as described above, it is possible to ground the common filament of the secondary circuit, care being taken that the rotor plates of the secondary condenser are joined to the filament side of the circuit. This will also have the effect of the ground shielding the set, and make it much easier to adjust. There will be no direct coupling between the primary and secondary circuits, as the primary condenser separates the primary inductance from the secondary inductance.

Another tip for regenerative circuit users. Remember that no matter what means are used to obtain regeneration (with exception of plate variometers, the current flowing in the tickler coil is of a unidirectional character. In other words, it flows through the coil in one direction only. Therefore, if the direction of winding on the tickler coil is opposed to that of the primary and secondary coils, there can be no regeneration. A simple method of determining this is to reverse the connections on the tickler coil, and compare the results.

Insuring Good Grid Connections

MY SET works more satisfactorily, I find, when I insure good grid connections by soldering a small brass or copper wire to the grid prong of the vacuum tube and to the brass base of the bulb and another wire to the upper rim of the brass base. The second wire is then connected with the grid leak and grid condenser.

This gives a fully soldered connection in the most important circuit of the set. I find that it reduces tube noises and adds to the efficiency of the set in bringing in distant stations with less amplification than usual.—JOHN A. MAHON, Baltimore, Md.



Connection is made through base of tube



EARLE E. LIEDERMAN as he is today

WHAT IS A BOOT-LEGGER?

He is nothing but a common law-breaker who exacts unreasonable prices from the public because of the chances he takes. But how many of us are almost as bad? We daily break the laws of Nature and think nothing of the terrible chances or consequences.

DO YOU KNOW THE LAW?

To look at the average man you would swear he never knew the laws of Nature or else he is just dumb crazy. He goes on stuffing any kind of food into his stomach till it sticks out like a room. He asks what a great risk he is taking when he thinks a meal he has run over to the stomach will be of his life and then blames his bad luck on the law. He never gives an ounce half a chance while his arms swing like pieces of rope with knots on the end.

FREEDOM

Cut it out fellows. Get wise to yourself. If Adam had looked like some of you, Eve would have fed him poison by means of apples. This free meal will never get you anywhere, but the great old law back to Nature's laws will be a real life man. Pull in your belt and blow out your chest. Give your lungs a free way to breathe oxygen this is all about you and you will get a better kick than you could get out of a whole case of whiskey.

90 DAYS

Will you turn your body over to me for just 90 days? That's all it takes and I guarantee to give you a new lease on life and a brand of "Un-learned" I guarantee this—90 days I will increase your weight one full inch and your chest will expand in the same length of time. And then just watch it grow. To me then on you will feel the legs of your old backbone. You will amaze yourself and your friends as well. Do you crave this new life—the new joys—the abounding health and strength? If you do

Send for My New 64-Page Book "MUSCULAR DEVELOPMENT"

It contains forty-three full-page photographs of myself and some of the many prize-winning pupils I have trained. Some of these capture me as a powerful weakling, impressing me to help them. Look them over now and you will marvel at their present physique. This book will prove an impetus and a real inspiration to you. It will thrill you through and through. At 10 cents (10 cents to cover the cost of wrapping and mailing and it is yours to keep. This will not obligate you at all, but for the sake of your future health and happiness, do not put it off. Send today—right now, before you turn this page.

EARLE E. LIEDERMAN

Dept. 1205, 205 Broadway, New York City

EARLE E. LIEDERMAN

Dept. 1205, 205 Broadway, New York City

Don't let 10 cents between 10 cents for which you are to send me, without any obligation on my part whatever a copy of your latest book "Muscular Development." Please write or print plainly.)

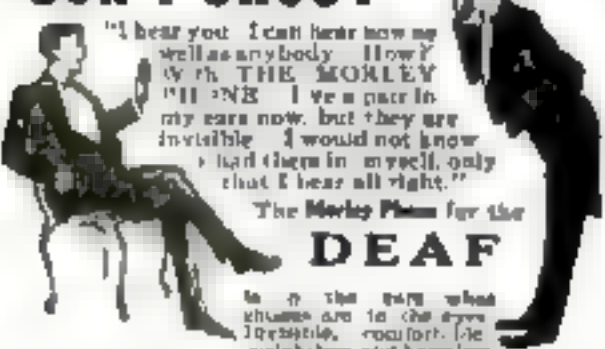
Name _____

Street _____

City _____

State _____

"DON'T SHOUT"



is it the ears that refuse to hear or is the brain that refuses to hear? The Morley Plan for the Deaf

Anyone can adjust it. Write for booklet and testimonials. THE MORLEY PLAN, Dept. 1205, 205 Broadway, New York City

TYPEWRITERS

17¢ a Day soon pays for a genuine Smith Underwood or L. C. Smith reliable typewriter. Have \$30 to \$50 on famous Larkins Easy Payment plan. Hundreds fulfilled. 5 Year Guarantee. 30 Day Trial. Send for FREE Book TODAY.



Larkins Co. Inc.
Dept. 1205-42 Buffalo, N. Y.

**"Let's Go—
Anywhere!"**

JUMP in, and -z-z-z-zip —we're off, to "anywhere"! Over highway and byway to secluded fishing waters—across a couple of states for a week-end tour—or just a peppy spin out the road and back after supper!

That's motorcycling, man—the greatest sport in the world! And a Harley-Davidson gives you everything in a motorcycle—speed, good looks, comfort, long life, low cost (fifty miles for a dollar—gas, oil, tires and all!)

Write now, for your free copy of "The Open Road." It tells all about the 1923 Harley-Davidson, with their 10 improvements and reduced prices.

Pay As-You-Ride—
ask your dealer about this
new, easy way to buy a
Harley-Davidson.

HARLEY - DAVIDSON
MOTOR CO.
Milwaukee, Wisconsin



2. Werbung enthält
 keine Angaben über
 den Namen der
 Firma. Hier steht:

Harley-Davidson The Motorcycle



You Can Save \$35²⁰

\$4.45 and up
Parma Fostald
and quarters sewed together, with rear fasteners, straps and jacks, complete. Available in all sizes. Give us, your desired number of your size. Catalog **FREE** A price is sent.

LIBERTY TOP & TIRE CO., INC. 1000 N. 1st St. Chicago, Ill.

THE HOME WORKSHOP

Small Motor Unit

(Continued from page 122)

side plates of the motor. In the large holes of these plates slides the slip shaft of the reducing gear device. On one end of this shaft is mounted a large gear, of a relatively fine pitch, with a two-step V pulley attached to it. The gear and pulleys are mounted on a single brass bushing and are keyed together, to drive as a unit. The small gear on the extension of the motor shaft, should be of micalta, or other silent running material, and be keyed solidly to the motor shaft.

Holes are drilled in the slip shaft for the pins that hold the gears either in or out of mesh, as required. Then, when it is desired to drive an appliance at full motor speed, or at a slight reduction, power is taken from the main motor pulley. If a greater reduction and more power is wanted, the gear is slipped into mesh with the pinion, and the power can be taken off either of the two countershaft pulleys. In this way a slow speed can be secured with a relative increase in power. A round belt is used.

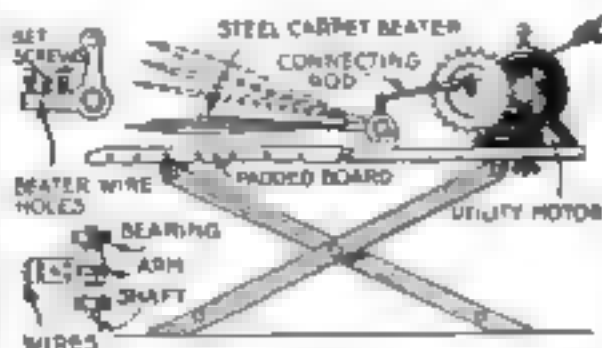
High Speed Egg Beating

Machines that require most power, such as ice cream freezers, food choppers or grinders, and dough mixers, are driven from the smallest of the geared pulleys. High speed machines are the egg beaters, cream whippers, and butter mixers.

The utility motor can be set on an overhead shelf with the power-operated machines below on a waist-high shelf. By having a slot in the upper shelf, the motor can be slid in two directions for taking up the belt slack. Most of the machines can be bought with integral clamping screws, and any homemade types should be similarly fitted.

The utility motor is also equipped with a handle so that it can be carried anywhere power is required. It can be used in the cellar to sift ashem, operate the washing machine and clothes wringer, and run small machinery in the home workshop. It can also be connected with the pump of the water storage system, if one is used.

In the kitchen its duties are obvious. It can also be used as the power plant of a



How the motor unit is used for operating a homemade rocket heater

homemade vacuum cleaner system of the type where the cleaner and motor are stationary and the cleaning and operating is done with a long hose fitted with various types of nozzles.

In the attic it can be utilized to run a mechanical carpet beater. This machine is made, as shown, out of an old ironing board. Mounted one third from the rear is a set of bearings, in which the shaft of the beater head is pivoted. The beater



Increase Your "A" Battery Efficiency

Hook up a Red Seal Radio Sparker to your W D-11 Tubes, instead of using a single dry cell for each tube, and you insure operating the tubes at maximum efficiency over a much longer period.

The two-cell Red Seal Radio Sparker, for example, lasts from 2½ to 3 times as long as a single cell.

With the Red Seal Radio Sparker, it is necessary to hook up only one battery. Made in 2, 6 and 8 cell sizes for operating from 1 to 4 W D-11 tubes. Full capacity, long life.

The label on each battery shows diagrams of the hook up, with complete instructions and suggestions for most efficient use.

Remember the name Radio Sparker.

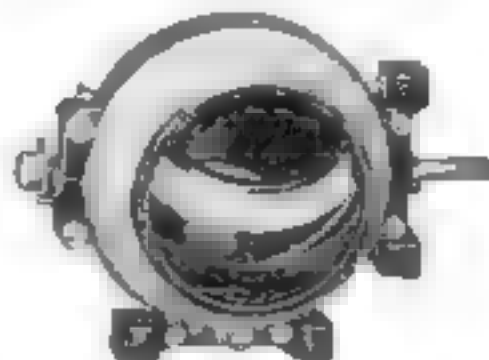
***The New Manhattan
Genuine Bakelite Line***

This new line of quality instruments will appeal to every radio user. In the Manhattan Variocoupler and Variometer perfect insulation and freedom from mechanical troubles are secured by use of genuine Bakelite, while electrical losses are kept down by reducing the amount of metal to the lowest point.

Bakelite mounting blocks permit installing the instruments on metal panels, if desired. Substantial pyramids connect with the rotating members, giving positive contact and quietness of operation.

The Manhattan Genuine Bakelite Knobs and Dials are non-warping, with highest precision and perfect alignment. The engraving is extremely clear.

For quality instruments ask for the Manhattan Genuine Bakelite line.



Manhattan Makette Variocoupler



MANHATTAN
ELECTRICAL SUPPLY CO. INC.

Makers of the famous Red Seal Dry
Batteries Sparkers and Manhattan
Radio Products

New York **Chicago**
St. Louis **San Francisco**



HIGH SCHOOL COURSE IN TWO YEARS

YOU ARE BADLY HANDICAPPED

If you lack High School training. You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

FIT YOURSELF FOR A BIG FUTURE

This course, which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, alert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and meets all requirements of a High School training. From the first lesson to the last you are carefully examined and coached.

USE SPARE TIME ONLY

Most people idle away fifty hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within two years. You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study.

Check and mail the coupon NOW for full particulars and Free Bulletin.

American School

Dept. M-572

Drexel Ave. and 38th St., Chicago

American School

Dept. M-572, Drexel Ave. & 38th St., Chicago
Send me full information on the subject checked and how you will help me win success.

- | | |
|-------------------------|--------------------------|
| Architect | Lawyer |
| Building Contractor | Mechanical Shop Practice |
| Automobile Engineer | Photoplay Writer |
| Automobile Mechanic | Mechanical Engineer |
| Civil Engineer | Shop Superintendent |
| Structural Engineer | Superintendent Manager |
| Business Manager | Steam Engineer |
| Cert. Public Accountant | Firearmship |
| Accountant and Auditor | Sanitary Engineer |
| Bookkeeper | Surveyor & Mapping |
| Draftsman and Designer | Telephone Engineer |
| Electrical Engineer | Telegraph Engineer |
| Electric Light & Power | High School Graduate |
| General Education | Fire Insurance Expert |
| Vocational Guidance | Wireless Radio |
| Business Law | Unskilled |

THE HOME WORKSHOP

Small Motor Unit

(Continued from page 123)

head is cast iron, drilled and fitted with a brass bushing, and also drilled for the admission of beater rods, held in place by the set screws. The device is connected with the motor through a wooden connecting rod, which is mounted on a small crankpin screwed into the side of the smallest pulley. This beater is an ideal machine for clothes and wraps, small rugs, and pillows.

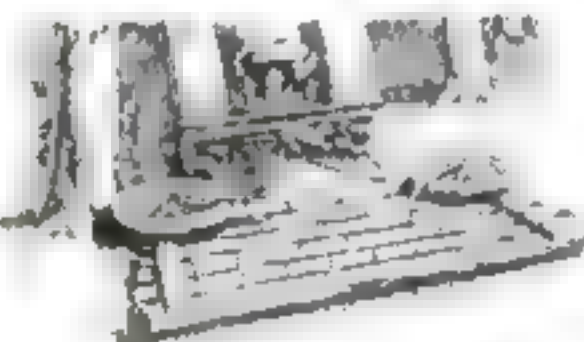
One of the handiest machines the home mechanic can make is the bottle washer illustrated. It consists of a horizontal spindle fitted with a pulley of small diameter, running in two bearings. A brush is screwed into the front end of the shaft. For washing milk bottles, fruit jars, flower vases, and a hundred and one other things, this bottle brush is most useful.

A utility motor, with its low cost of operation and extreme flexibility, will do more than anything else to lighten the housewife's work.



For cleaning bottles

Auto Wheels on Harrows Save Trees from Injury



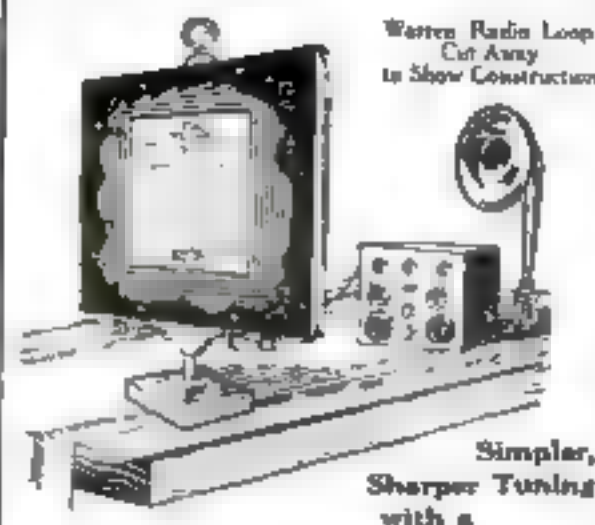
THE danger of barking orchard trees when mowing cover crops can be avoided if the harrow is fitted, as shown, with auto wheels and cheap tires. The treads of the tires should extend 4 or 5 in. over the corners at each side — P. T.

Portable High-Chair Attachment for a Dining Chair

WITH the simple little seat illustrated, an ordinary chair can be converted into a high chair for baby. The seat is made of 3/4-in. wood and the table portion of it is arranged on two arms, the opposite ends of which are pivoted to the sides of the seat. This allows the table to swing back over the child's head.



Two small blocks on the side of the seat serve as stops for the table. Two heavy wire hooks covered with rubber tubing are attached to the back of the seat, and these are used for attaching it to the back of any straight chair. The seat and table may be painted with white enamel or finished in the natural wood to match the dining-room furniture. — J. B. MORAN.



Warren Radio Loop Cut Away to Show Construction

Simpler, Sharper Tuning with a

Warren Radio Loop

AERIAL and tuning device all in one. Tunes not only to wave length but to wave direction. An aid to selection. Eliminates atmospheric. All enclosed—dust and damp proof, fool-proof and surprisingly compact, neat and durable. Write today for Bulletin U-102, containing hookups.

A Type for Every Set At the Best Dealers

Type A-717 (300-700 meters) 6 inches square—non-directional	\$19
Type A-7136 (175-1000 meters) 6 inches square—non-directional	18
Type B-2517 (300-700 meters) 18 inches square—directional	20
Type B1-1510 (200-18,000 meters) with loop comb coil, 8 inches square—directional	25

V-DE-CO RADIO MFG. CO.
ASBURY PARK, N. J.
Dept. O.

Cultivate Your musical Bump

Try
Lew's
Jazz Club
Plays a CONN

There is no other way to learn to play jazz than by playing with a jazz club. It is the only kind of band and orchestra that can be learned in the most practical way because it is the only one that is actually played.

It is easier to play jazz in a jazz club than in any other way. It is the only way to learn to play jazz in the most practical way because it is the only one that is actually played.

More Conn saxophones are sold than any other make in the world. This is because they are the only saxophones that are actually played.

Free Trial! Easy Payments! Write for details, name, address, and phone.

CONN saxophones are sold in every city.

C. G. CONN, Ltd. 511 Conn Bldg. Elkhart, Ind.

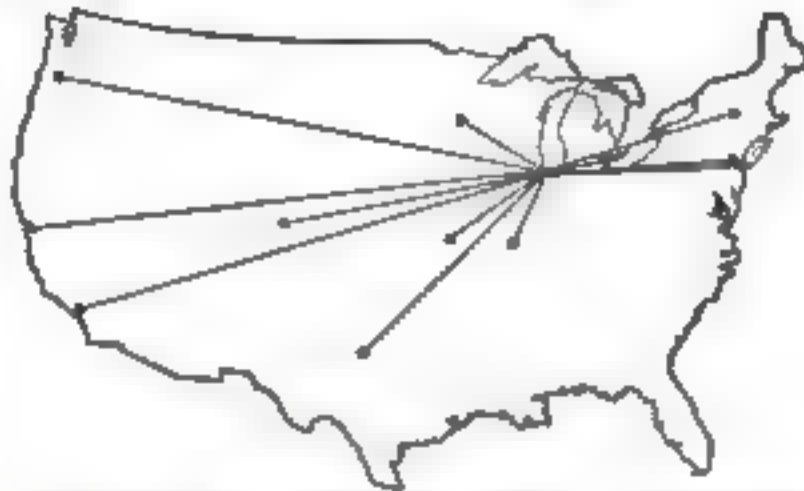
CONN saxophones are sold in every city.

\$25.00 in Prizes

See page 4 in front of book for full details

What One Tube Did In a Single Evening

New York City
Newark, N. J.
Detroit, Mich.
Kansas City
Minneapolis
Denver
St. Louis
Los Angeles
San Francisco
Portland, Ore.



Loud Speaker Was Used!

Typical of the amazing results that are being secured daily with the new Erla Duo-Reflex circuit using but a single vacuum tube, is the experience of Dr. G. Edwin Farley, of Beverly Hills, Ill., who writes:—

"Between 9 p. m. and 2 a. m. Dr. Duff a friend of mine, and I, listened to New York City, Newark, Troy, Detroit, Stanford, Tex., Kansas City, Minneapolis, Denver, St. Louis, Los Angeles, San Francisco, and Portland, —all, with the exception of the last very clear and loud. Most were heard on the loud speaker.

The basis of this new circuit, and the main spring of its efficiency is the Erla radio frequency transformer. Free diagrams of the circuit, with notes regarding its construction are available. Ask your dealer or write.

ERLA Electrical Research Laboratories
Dept. F, 2515 Michigan Avenue, Chicago



Erla radio frequency transformers greatly improve the range and power of any receiving set incorporating utmost efficiency and value. Results guaranteed. List, 84

Sanitary Chute Carries Trash from Kitchen to Cellar

By William Draper Brinchlow

EVER notice how fast kitchen trash collects? Empty cartons, cans, broken china, wrapping paper—there's a good sized box of it every day or so.

Here's a suggestion for making a chute to take care of the rubbish in a sanitary way and, at the same time, to save steps and labor. If there is a cupboard in your kitchen something like that illustrated, you can utilize half the lower part, which usually is not of much value because of the stooping necessary to get at things down there. If no cupboard is available, a boxlike compartment can be built under the sink drainboard or in some other convenient location.

If a cupboard is to be used, we'll take off one door, build a little partition of matched boards, dividing the lower part



The pivoted door to the chute is self closing

in halves, and cut out the shelf in the left-hand half. Next, we'll saw away the floor boards in this portion, leaving a hole right through to the cellar. We must make this hole as large as possible, which will be easy enough if the joists run as shown. If they run the other way and one cuts across the hole, we'll bevel the top edge.

Next, we'll replace the door, hanging it on pivots, a little above the center. "Surface sash pivots" can be bought at the hardware store, or twelvapenny nails, or larger, can be put through the frame, at each side, into the edge of the door. Bore holes for the nails, so that they fit rather loosely; they then can be easily pulled out to take the door off for cleaning or whitewashing the chute.

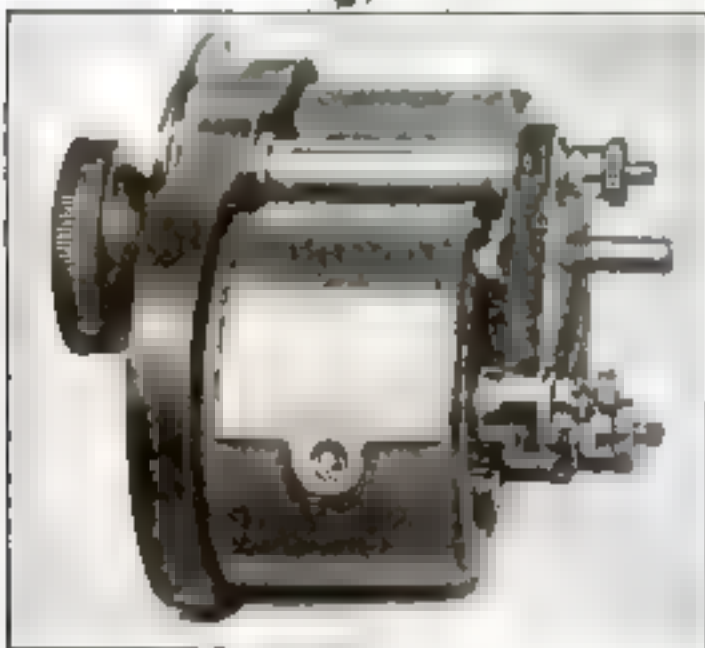
There ought to be a stop projecting from the inside of the frame, near the top, so that the door cannot swing inward. A small block or bent nail will answer. We must also put a knob or handle at the top of the door.

Now, suppose your wife is standing at the sink, opening a can of salmon, or unwrapping the meat. As she finishes, she pulls the door open a bit, and drops down the empty can or soiled paper. Or sup-

Earn \$50 a day
Selling men's rain-coats
GOODYEAR RAINCOATS
11 Coats in 10 different styles. Sample with you is worth \$15.00. Write for list of prices and order forms.
GOODYEAR RUBBER MFG CO.
Dept. C 24 E 9th Street, N. Y. C.

For 58 years these little machines have been making music for the world to enjoy.
Everything for the BAND PLAYER!
We are a complete band outfit. We have everything you need for your band. We have the best of everything. We have the best of everything. We have the best of everything.
LYON & HEALY, 72-77 Jackson Blvd., CHICAGO

Brooks Variable Condenser



Two Ribbons Furnished Easily Interchangeable

Adjustable for all receiving

by 1/2 inch increments

Size 1/2 inch increments

1/2 inch increments

Retail \$4.75
Price 4 each
Complete with Dial

Manufactured by

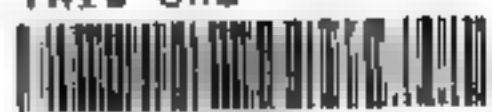
METRIC METAL WORKS

American Meter Company, Inc.
ERIE, PA.

JOBBER WANTED

Write for Prices and Discounts

This One



2PP1-4PO-REYF

THE HOME WORKSHOP

pose she is sweeping the kitchen; she collects the litter in a heap in front of the door and with a brisk stroke of the broom pushes back the bottom of the door, and sends all the rubbish to the cellar.

You can set an ashcan or box to catch the litter on a shelf, so that the top of the receptacle will be near the under side of the hole. A better scheme, perhaps, is to make a cage of heavy wire netting. An old square baking pan will do for the bottom; punch holes around the rim with a nail, and fasten the netting by twisting wires through these holes.

Every so often, as this cage gets full, carry it to the back yard, set it down, and touch a match to the contents. When the fire is out, empty the residue of ashes, cans and broken china into the ashcan. The burning will purify this cage perfectly.

Whitewash the inside of the door and the chute every now and then.

In This Issue

	PAGE
Editorials.....	2
What Scientists Are Saying.....	27
Airplanes to Diesel Png.....	28
My Adventures with Laughter.....	31
An Interview with Will Rogers.....	32
Man—An Animal Invention.....	32
Article J in the Series, "The Story of Man and His World".....	
By E. B. Free, Ph.D., and William K. Gregory, Ph.D.	
A Baby—An Open Safety Pin.....	33
Thumbprints to Identify Paintings.....	34
Is Milk the Perfect Food?.....	37
A New Broadcasting Plan.....	38
By Jack Bunn.....	
Miniature Piano Trains Gunners.....	39
Autos Weighed without Jacks.....	39
Are You Too Fat?.....	40
Hooligan Fish Burn as Candles.....	42
Air Cooling for Automobiles.....	43
What Bright Lights Cost New York.....	44
Automatic Quartermaster Steers Ship.....	44
Alarm Clock Switches off Lights.....	44
Illuminated Lifeline.....	45
Midget Cycloear Coupe.....	45
Boring Highway under the Hudson.....	46
Postage Stamps Form Mosaic.....	48
World's Largest Handsaw.....	48
Container Sponge Spreads Mucilage.....	48
Car Is Truck for Unlabeled.....	48
Rented Goats Clear Farm Land.....	49
Oil-Lens Detects Counterfeits.....	50
Motorized Bucket Cleans Sewers.....	50
Chickens Eat "Cafeteria Style".....	51
Hand Crank Runs Truck Loader.....	51
Auto Speeders Checked Automatically.....	51
Motor Driven Bracket Drill.....	51
Fisherman Goes to Sea in Wagon.....	52
Speedball—The Newest Sport.....	52
Dope—Where It Comes From.....	53
An Interview with Dr. Caroline Simon.....	
Building a Giant Airship Hangar.....	54
Tiny Motor Starts Novel Glider.....	55
Switch in Handle of Trouble Lamp.....	55
Mushroom Matures in 12 Hours.....	55
Electric Log Tells Ship's Speed.....	56
Self-Holding Shoe Last.....	56
Using Electricity to Age Wine.....	56
Concrete Armor to Protect Piles.....	57
Automatic Road Building Truck.....	57
Portable Jointed Tube Bridge.....	58
Movie Screen Shows Embryo Growth.....	58
Three-inch Walls Keep Out Noise.....	59
Ballast Cleaner for Railways.....	59
The Month's Novelties in Photos.....	60
Blizzard Warnings from the Arctic.....	61
Sliding Celluloid Windows for Autos.....	62
Ruler Serves as Blotter.....	62
Colors Fused into Glass.....	62
Aircushion Rowboat Tied in Bundle.....	62
Manikins Used by Auto Designer.....	63
Shockproof Wheels for Motor Truck.....	63
3600 Fathoms under the Sea.....	64
A Dozen Machine Tools in One.....	65
The World's Queerest Animal.....	66
New Wing Flap Airplane Control.....	66
To Broadcast Baseball by Radio Movies.....	67
Peanuts in 145 Varieties.....	68
Iron Finger Finds Sunken Treasure.....	69
Labor Saving Household Devices.....	70
Bandsaw Cuts Wood or Metal.....	71
Tree Branches Spliced by Grafting.....	71
A New Way to Pull Weeds.....	71
Cart Serves as Camping Table.....	71
Angler Outdistances Babe Ruth.....	72
How Climate Affects Your Energy.....	72
Searching for "Lost Pharaoh".....	73
Conveniences for Spring Touring.....	74
How to Cut Your Car Costs.....	75
By Harold F. Monckard.....	
Tire Changing Champions.....	77
Handy Toolboxes for Your Car.....	78
Enlarging a Steering Wheel.....	78
Two Spark Plug "Kinks".....	78

The Home Workshop . . . Page 79
Better Shop Methods . . . Page 84



The FLORSHEIM SHOE

With all their refinement FLORSHEIM SHOES are sturdy—enduring. Style is a part of them—not merely a surface finish.

The Florsheim Shoe—Most Styles \$10

SMOKELET "STYLES OF THE TIMES" ON REQUEST
Look for Name in Shoe

THE FLORSHEIM SHOE COMPANY

Manufacturers • CHICAGO





Easy to Play Easy to Pay

Clyde C. Doerr, B. M.,
Director, Club Royal Orchestra, makers of Victor Records for dancing. Hear their Buescher instruments on your phonograph.

The Most Prominent Professionals

Use True-Tone Musical Instruments. They have helped make famous Paul Whiteman, Tom Brown, Art Hickman, Donald Clark, Clay Smith, Guy Hudson, Mervyn Evans, Joseph C. Smith, Ben Selvin, Ben Kruger, Henry Sauter, Vincent Lopez and thousands of others. \$500 to \$1,000 weekly for but two hours a day is not uncommon for musicians of such ability to earn. You may have equal talent and enjoy the most pleasant of vocations. 75% of all popular phonograph records are played with Buescher instruments.

Free Saxophone Book

After nearly 100 years' serving instruments are truly displaced by Saxophones in all climates. Our Free Saxophone Book tells which Saxophone takes violin, cello and bass parts, and many other things you would like to know. Ask for your copy.

BUESCHER

True-Tone Saxophone

Unrivalled for home entertainment, church, lodge or school. In big demand for orchestra dance music. Buescher popularity and superiority is proven by the fact that Buescher makes more Saxophones than all other manufacturers combined.

Free Trial—Easy Payments

You may order any Buescher Saxophone, Clarinet, Trumpet, Trombone, or other Band or Orchestra Instrument without paying in advance, and try it six days in your own home, without obligation. If perfectly satisfied, pay for it in easy payments to suit your convenience. Mention the instrument interested in and a complete catalog will be mailed free. Send the coupon for a free copy of the most interesting booklet on the Saxophone ever published.

BUESCHER BAND INSTRUMENT CO.

Makers of Everything in Band and Orchestra Instruments
3165 Buescher Block - Elkhart, Indiana.

BUESCHER BAND INSTRUMENT CO.

3165 Buescher Block, Elkhart, Indiana

Kindly mail to me Saxophone Book.

Shall we also send you free Complete Catalog of all Buescher True-Tone Band Instruments?

Name.....

P. O. Address.....

Instrument I play is.....

Sax Invented the Saxophone
Buescher Perfected It



Cunningham

Tubes for Every Requirement

Vacuum tubes are used for two distinct individual purposes in a receiving set—as DETECTORS and as AMPLIFIERS. The qualifications of a tube for these two uses are so different that for maximum efficiency tubes of entirely different design must be used.

This point was one of the chief considerations of the research engineers who designed Cunningham tubes in the great laboratories of the General Electric Company. After years of research and experimental work, the Cunningham C-300, a SUPER-SENSITIVE DETECTOR, the Cunningham C-301, a DISTORTIONLESS AMPLIFIER, and the Cunningham C-301A, a LOW FILAMENT CURRENT AMPLIFIER, were developed. These three tubes, now nationally recognized as standards for all types of receiving sets, are responsible for the highly perfected results obtainable in radio phone reception.



The trade mark GE is the guarantee of these quality tubes. Each tube is built to meet rigid specifications.

TYPE C-300

Super-Sensitive
DETECTOR
\$5.00

TYPE C-301A

1/4 Amp. Fil-Current
Amplifier and Detector
\$6.50

Patent Notice—Cunningham tubes are covered by patents dated 11-7-25, 1-15-27, 2-18-28 and others issued and pending. Licensed for amateur, experimental and entertainment use in radio communication. Any other use will be an infringement.

T. J. Cunningham

Home Office:
248 First Street
San Francisco, Calif.

Eastern Representative:
154 West Lake St.
Chicago, Illinois

A MAGNAVOX Power Amplifier *for your* Magnavox Reproducer

MAGNAVOX products are made for people who judge Radio equipment as expertly as the engineer judges a locomotive or a musician a violin.

To answer such requirements, the Magnavox Power Amplifier was developed for use with the Magnavox Radio, the Reproducer Supreme.

Under present conditions, the combination of Magnavox Reproducer and Power Amplifier represents the last refinement in Radio reception—a demonstration at your dealer's is the convincing proof.

R2-18 Magnavox Radio (With 18-inch horn)

This instrument is intended for those who wish the utmost in amplifying power; for clubs, hotels, dance halls, large audiences, etc. It requires only .6 of an ampere for the field.

Price \$60.00

R3-14 Magnavox Radio (With 14-inch horn) *As illustrated*

The ideal instrument for use in homes, offices, amateur stations, etc. Same in principle and construction as Type R-2.

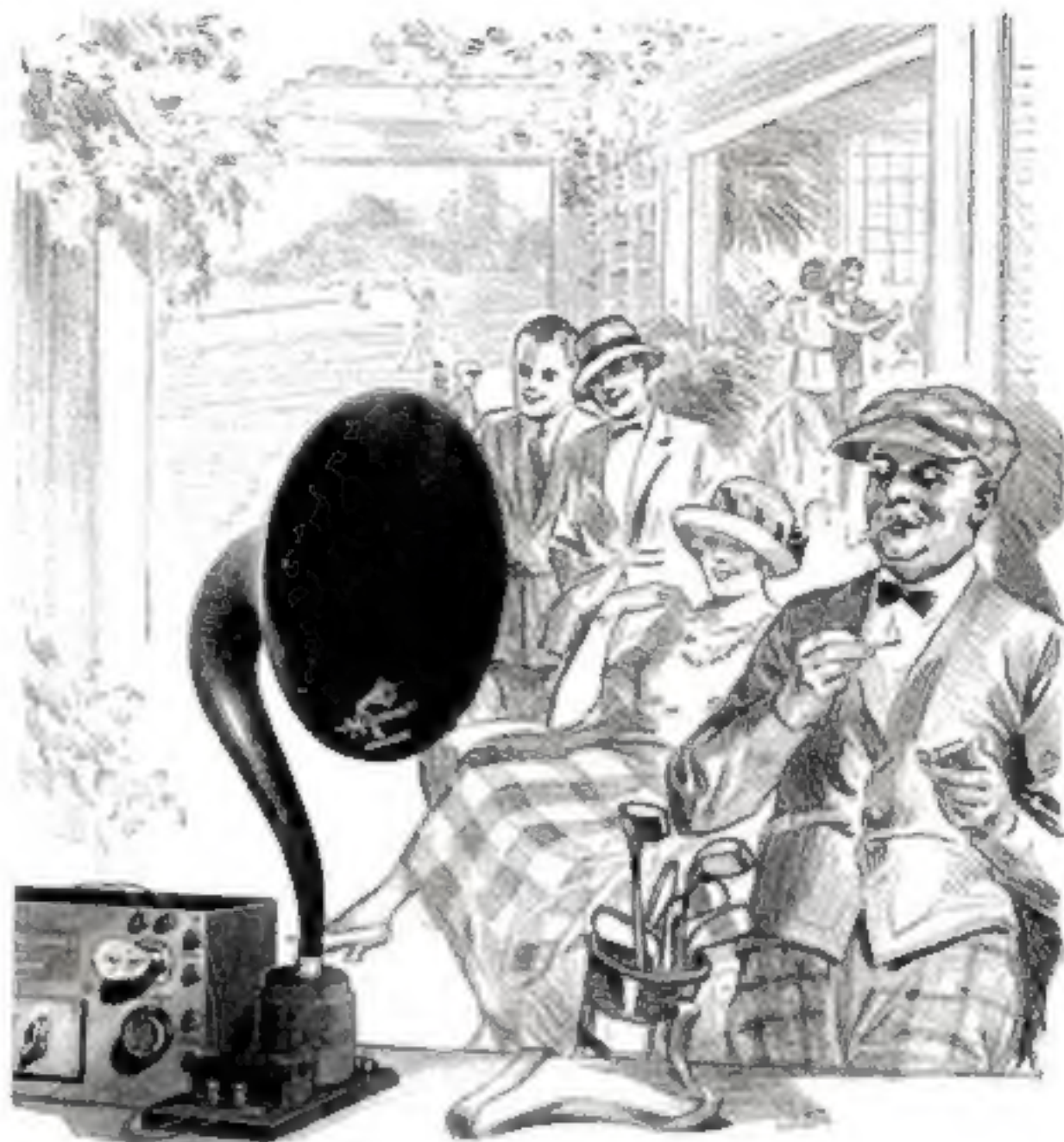
Price \$35.00

AC Magnavox Power Amplifier *As illustrated*

For use with the Magnavox Radio and insures getting the largest possible power input.

2-stage, \$55.00
3-stage, \$75.00

Magnavox Reproducers and Power Amplifiers can be used with any receiving set of good quality. Without Magnavox, no receiving set is complete.



On the Veranda of the Country Club

WHERE Radio apparatus, like a professional entertainer, must meet the test of satisfying really discriminating people, Magnavox is certain to be installed.

The first requisites—tone clearness, pitch and quality—are fulfilled by the Magnavox Reproducer; the addition of a Magnavox Power Amplifier supplies the other requisite, volume.

Magnavox Products can be had from good dealers everywhere. Our interesting new booklet will be sent on request.

The Magnavox Co., Oakland, California
New York: 370 Seventh Avenue

MAGNAVOX

Radio

The Reproducer Supreme

"Don't I
know it?"



Satisfy



Chesterfield
CIGARETTES